SKRIPSI

PENJADWALAN *FLOW SHOP* N *JOB* M *MACHINE* DENGAN METODE HEURISTIK ALGORITMA *POUR, NEIGHBORHOOD SEARCH TECHNIQUES,* DAN *TABU SEARCH*

Diajukan Sebagai Salah Satu Syarat untuk Memperoleh Gelar Sarjana Teknik

Diajukan oleh :

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PROGRAM STUDI TEKNIK INDUSTRI

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YOGYAKARTA

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Setelah membaca, meneliti, memberikan petunjuk dan mengoreksi serta mengadakan perbaikan seperlunya, maka kami selaku pembimbing berpendapat bahwa skripsi Saudara:

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sudah dapat diajukan kembali kepada Program Studi Teknik Industri Fakultas Sains dan Teknologi UIN Sunan Kalijaga Yogyakarta sebagai salah satu syarat untuk memperoleh gelar Sarjana Strata Satu dalam bidang Teknik Industri

Dengan ini kami mengharap agar skripsi/tugas akhir Saudara tersebut di atas dapat segera dimunaqsyahkan. Atas perhatiannya kami ucapkan terima kasih.

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Yogyakarta, 11 Agustus 2016

Yang menyatakan,

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HALAMAN PERSEMBAHAN

Tugas akhir ini saya dedikasikan kepada

Kedua orangtuaku yang tercinta

Adikku yang selalu kubanggakan

Seluruh keluargaku

Almamaterku

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Universitas Islam Negeri Sunan Kalijaga

HALAMAN MOTTO

فَإِنَّ مَعَ ٱلۡعُسۡرِ يُسۡرًا ۝٥ إِنَّ مَعَ ٱلۡعُسۡرِ يُسۡرًا ۝٦ فَإِذَا فَرَغۡتَ فَٱنصَبۡ ۝٧ وَإِلَىٰ رَبِّكَ فَٱرۡغَب ۝٨

Surely with difficulty is ease.[5] With difficulty is surely ease.[6] So when you are free, nominate.[7] And make your Lord your exclusive object. [8]

(Al-Insyirah 5-8)

Between the great things we cannot do and the small things we will not do, the danger is that we shall do nothing.

(Adolphe Monod)

멈추지 말고 계속 해나가기만 한다면 늦어도 상관없다

(Anonim)

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Yogyakarta, 11 Agustus 2016

Penulis,

Wahyu Eddy Fatoni

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ABSTRAK

Penjadwalan didefinisikan sebagai pengalokasian sumber daya yang terbatas untuk mengerjakan sejumlah tugas. Penelitian ini membahas mengenai penjadwalan *flow shop* n *job* m *machine* dengan pendekatan metode heuristik algoritma *Pour, Neighborhood Search Techniques*, dan *Tabu Search*. Tujuan penelitian ini adalah membandingkan dan mengetahui performansi antara ketiga metode heursitik tersebut untuk meminimalkan *makespan.* Dalam penelitian ini data yang digunakan adalah data waktu proses berupa data *random* yang dibangkitkan dengan *software* Matlab 7.1. Kombinasi jumlah *job* dan *machine* yaitu skala kecil dengan kombinasi 8 *jobs* 3 *machines* (*small size*), skala sedang dengan kombinasi 13 *jobs* 3 *machines* (*medium size*), dan skala besar kombinasi 44 *jobs* 34 *machines* (*large size*).

Parameter performansi yang digunakan yaitu *makespan* rata-rata, *Efficiency Index* (EI), *Relative Error* (RE), dan *Run Time* rata-rata. Hasil penelitian ini menunjukkan bahwa metode terbaik untuk penjadwalan *flow shop* n *job* m *machine* dalam meminimalkan *makespan* adalah metode heuristik algoritma *tabu search* karena memiliki nilai *makespan* rata-rata terkecil yaitu 545.45 *time unit* dengan kombinasi 8 *jobs* 3 *machines*, 822.79 *time unit* dengan kombinasi 13 *jobs* 3 *machines*, dan 5135.44 *time unit* dengan kombinasi 44 *jobs* 34 *machines*. Hasil *run time* rata-rata diperoleh bahwa metode heuristik algoritma *tabu search* memiliki *run time* paling lama yaitu 4.851 detik dengan kombinasi 8 *jobs* 3 *machines*, 10.506 detik dengan kombinasi 13 *jobs* 3 *machines*, dan 111.889 detik dengan kombinasi 44 *jobs* 34 *machines*. Meskipun metode heuristik algoritma *tabu search* memiliki nilai *run time* paling lama, namun nilai *run time* tersebut masih dapat ditoleransi.

Kata kunci : flow shop, neighborhood search techniques, parameter performansi, penjadwalan, pour, tabu search

BAB I

PENDAHULUAN

1.1. Latar Belakang

Proses produksi merupakan serangkaian kegiatan untuk menghasilkan atau menambah nilai guna suatu produk agar lebih bermanfaat bagi kebutuhan manusia. Urutan pengerjaan produk pada proses produksi memiliki pengaruh terhadap penyelesaian produk yang ada, salah satunya adalah total waktu penyelesaian. Oleh karena itu, diperlukan pengurutan pengerjaan produk yang disebut dengan penjadwalan produksi. Penjadwalan merupakan salah satu kegiatan penting dalam proses produksi. Penjadwalan menurut Baker et al. (1974) didefinisikan sebagai berikut "*Scheduling is the allocation of resources overtime to perform collection of tasks.*", yang diartikan sebagai pengalokasian sumber daya yang terbatas untuk mengerjakan sejumlah tugas.

Penjadwalan produksi *flowshop* merupakan salah satu kegiatan perencanaan produksi. Menurut Baker (1974), penjadwalan *flowshop* merupakan salah satu jenis penjadwalan produksi dimana setiap n *job* akan melalui setiap m *machine* dengan urutan yang sama. Penjadwalan *flowshop* merupakan suatu pergerakan unit yang terus-menerus melalui serangkaian stasiun kerja yang disusun berdasarkan produk. Pada penjadwalan *flowshop*, sumber daya yang dialokasikan akan dilewati oleh setiap pekerjaan (*job*) secara berurutan, atau setiap *job* memiliki urutan pengerjaan yang sama.

Penjadwalan produksi melibatkan n *job* dan m *machine* dalam proses produksinya, dimana setiap *job* memiliki informasi tentang jenis produk dan jumlah pesanan. Setiap *job* memiliki waktu proses yang berbeda dalam pengerjaan setiap mesin. Penjadwalan produksi bertujuan untuk mengurutkan pengerjaan *job* agar mendapatkan suatu kondisi yang optimal.

Performasi penjadwalan tergantung pada kriteria yang digunakan. Kriteria yang digunakan pada penjadwalan yaitu rata-rata waktu penyelesaian *job* (*mean flow time*), minimasi rata-rata penyimpangan waktu antara waktu penyelesaian pekerjaan dengan *due date* (*mean lateness*), minimasi rata rata keterlambatan (*mean tardiness*), maksimasi utilitas rata-rata mesin, total waktu untuk penyelesaian setiap *job* (*makespan*), atau kriteria-kriteria penjadwalan yang lain. Penentuan penjadwalan untuk memenuhi seluruh kriteria yang ada sulit untuk diterapkan. Oleh karena itu, diambil kriteria yang dapat mewakili seluruh kriteria yang ada yaitu meminimalkan *makespan*, yaitu waktu yang dibutuhkan untuk menyelesaikan semua *job* dalam sistem produksi.

Masalah penjadwalan produksi dapat diselesaikan dengan beberapa metode penjadwalan, yaitu metode berdasarkan *priority dispatch rule* suatu aturan penjadwalan yang mengatur *job* mana pada suatu antrian *job* pada suatu mesin yang harus diproses terlebih dahulu berdasarkan prioritas-prioritas tertentu (Adam dan Ronald, 1992). Metode *priority dispatch rule* tersebut antara lain *First Come First Serve* (FCFS), *Earliest Due Date* (EDD), *Minimum Slack First* (MS), *Shortest Processing Time* (SPT),

Longest Processing Time (LPT), dan *Weighted Shortest Processing Time* (WSPT). Johnson (1954) merupakan pionir dalam penelitian mengenai penjadwalan *flow shop*. Dalam penelitian Johnson hanya berfokus pada n *job* 2 *machine*, kemudian diikuti oleh peneliti lain yang mengembangkan metode penjadwalan yang lebih luas yaitu pada skala n *job* m *machine*. Sehingga, muncul metode-metode heuristik yang telah dikembangkan seperti algoritma *Ignall-Scharge* (1965), algoritma *Palmer* (1965), algoritma CDS oleh *Campbell, Dudek, dan Smith* (1970), algoritma *Gupta* (1971), algoritma *Dannenbring* (1977), algoritma NEH oleh *Nawaz, Enscore*, dan *Ham* (1983), algoritma *Neighborhood Search Techniques*, algoritma *Tabu Search* (1986), algoritma *Simulated Annealing* (1988), algoritma Genetik (1975), algoritma *Differential Evolution* (1995), algoritma *Harmony Search* (2001), dan algoritma *Pour* (2001).

Banyak penelitian mengenai studi komputasi untuk menentukan performansi masing-masing metode penjadwalan serta untuk membandingkan performansi dari beberapa metode penjadwalan tersebut. Dari penelitian studi komputasi yang telah dilakukan kemudian didapatkan metode penjadwalan terbaik sesuai dengan parameter performansi yang telah ditentukan diawal penelitian.

Taillard (1990) dalam penelitiannya menyatakan bahwa algoritma *tabu search* merupakan algoritma heuristik terbaik dibandingkan algoritma heuristik klasik. Kurniati et al. (2014) menyatakan bahwa terjadi penurunan *mean flow time* antara kondisi eksiting dengan menggunakan *algoritma*

branch and bound dan *neighborhood search*. Salah satu algoritma heuristik yang telah dikembangkan yaitu algoritma *Pour*. Pour (2001) mengembangkan metode heuristik baru yang diberi nama algoritma *pour* untuk meminimalkan *makespan* pada permasalahan penjadwalan *flow shop* n *job* m *machine*. Dalam penelitian tersebut, membandingkan performansi algoritma *pour* dengan algoritma CDS, algoritma NEH, dan algoritma *Palmer*. Algoritma *pour* menunjukkan performansi terbaik dibandingkan dengan algoritma lain. Soetanto et al. (2004) juga menyebutkan bahwa algoritma *pour* memberikan performansi yang cukup baik dalam menyelesaikan permasalahan penjadwalan *flow shop* dibandingkan dengan metode optimasi *Mixed Integer Programming* (MIP). Selain itu, Irsyad (2015) juga menyatakan bahwa algoritma *pour* memiliki hasil lebih baik dibandingkan metode FCFS dan EDD.

Berdasarkan gambaran diatas maka dalam tugas akhir ini akan dilakukan penelitian mengenai studi komputasi. Studi komputasi dilakukan untuk membandingkan dan mengetahui performasi dari metode heuristik algoritma *pour*, *neighborhood search techniques* (NST), dan *tabu search* dalam menentukan penjadwalan *flow shop* n *job* m *machine* untuk meminimalkan *makespan*. Penelitian studi komputasi ini dilakukan dengan menggunakan data *random* yang dibangkitkan oleh komputer sebagai data penelitian.

1.2. Rumusan Masalah

Berdasarkan latar belakang masalah yang telah dipaparkan diatas, maka rumusan masalah dalam penelitian ini adalah :

1. Bagaimana perbandingan performansi metode heuristik algoritma *pour*, NST, dan *tabu search* dalam penjadwalan *flow shop* n *job* m *machine* untuk meminimalkan *makespan*?
2. Apakah metode heuristik terbaik untuk penjadwalan *flow shop* n *job* m *machine* untuk meminimalkan *makespan*?

1.3. Tujuan Penelitian

Adapun penelitian ini memiliki beberapa tujuan, diantaranya adalah :

1. Melakukan studi komputasi dengan menggunakan data *random* yang dibangkitkan dengan komputer terhadap metode heuristik algoritma *pour*, NST, dan *tabu search* dalam menyelesaikan permasalahan penjadwalan *flow shop* untuk meminimalkan *makespan*.
2. Membandingkan dan mengetahui performansi penjadwalan terbaik terhadap metode heuristik algoritma *pour*, NST, dan *tabu search* untuk meminimalkan *makespan*.

1.4. Manfaat Penelitian

Adapun manfaat yang diperoleh dari penelitian ini sebagai berikut :

1. Mengetahui metode heuristik terbaik dalam penjadwalan *flow shop* n *job* m *machine* untuk meminimalkan *makespan*.
2. Memberikan usulan penjadwalan terbaik.

1.5. Batasan Masalah dan Asumsi

Dalam penelitian ini terdapat beberapa batasan masalah yang dimaksudkan agar penelitian tidak melebar. Adapun batasan dalam masalah ini antara lain :

1.5.1. Batasan Masalah

Batasan masalah pada penelitian ini adalah :

1. Pada penelitian ini dibatasi untuk permasalahan skala kecil dengan kombinasi 8 *jobs* 3 *machines* (*small size*), skala sedang dengan kombinasi 13 *jobs* 3 *machines* (*medium size*), dan skala besar dengan kombinasi 44 *jobs* 34 *machines* (*large size*).
2. Data penelitian berupa waktu proses tiap *job* pada *machine* dibangkitkan oleh komputer secara *random* dengan menggunakan *software* Matlab versi 7.1.
3. Studi komputasi dalam penelitian ini dilakukan dengan membuat program (*coding*) penjadwalan dengan menggunakan *software* Matlab versi 7.1.

1.5.1. Asumsi

Asumsi-asumsi yang digunakan dalam penelitian ini yaitu :

1. Waktu *set-up* mesin untuk setiap operasi dan mesin dimasukkan dalam waktu proses.
2. Waktu transportasi diabaikan.
3. Satu mesin hanya dapat memproses satu pekerjaan

4. Semua mesin tersedia dalam kondisi baik atau dapat beroperasi dengan nomal, mengabaikan terjadinya *breakdown* dan *rework*.
5. Fungsi tujuan yang ingin diperoleh yaitu meminimalkan *makespan*.

1.6. Sistematika Penulisan

Adapun sistematika penulisan pada penelitian ini sebagai berikut :

BAB I PENDAHULUAN

Bab ini berisi tentang hal-hal yang mendasari dilakukannya penelitian serta pengidentifikasian masalah penelitian. Bagian-bagian yang terdapat dalam bab pendahuluan ini meliputi latar belakang penelitian, rumusan masalah, tujuan penelitian, manfaat penelitian, batasan masalah dan asumsi, serta sistematika penulisan.

BAB II TINJAUAN PUSTAKA

Bab ini berisi tentang uraian mengenai teori, temuan, dan bahan penelitian lain yang diperoleh dari acuan. Seperti pengertian penjadwalan, tujuan penjadwalan, istilah dalam penjadwalan, jenis-jenis penjadwalan, penjadwalan *flow shop*, penjadwalan *batch*, penjadwalan *job shop*, konsep algoritma, algoritma *pour*, algoritma NST, algoritma *tabu search*, dan parameter performansi. Kemudian dijadikan landasan untuk melakukan kegiatan penelitian yang akan dijadikan sebagai tugas akhir.

BAB III METODOLOGI PENELITIAN

Bab ini berisi tentang metodologi penelitian yang dilakukan dalam membandingkan algoritma *pour*, algoritma NST, dan algoritma *tabu search* dalam penyelesaian penjadwalan *flow shop* untuk meminimalkan *makespan*. Pada bab ini menentukan jumlah *job* dan *machine*, interval data waktu proses, *number of run* dalam penelitian, parameter-parameter yang digunakan dalam algoritma NST dan algoritma *tabu search*, serta diagram alir penelitian.

BAB IV HASIL DAN PEMBAHASAN

Bab ini berisi tentang hasil perhitungan *makespan* dari metode heuristik algoritma *pour*, algoritma NST, dan algoritma *tabu search* yang ditampilkan pada tabel grafik, hasil perhitungan parameter performansi *efficiency index* (EI) dan *relative error* (RE), serta *run time* rata-rata dari ketiga algoritma tersebut.

BAB V KESIMPULAN DAN SARAN

Bab ini berisi tentang kesimpulan dari pembahasan terhadap algoritma *pour*, algoritma NST, dan algoritma *tabu search* berdasarkan hasil *makespan* rata-rata, parameter performansi EI dan RE, serta *run time* rata-rata. Bab ini juga menyajikan saran bagi penelitian selanjutnya.

BAB V

KESIMPULAN DAN SARAN

5.1. Kesimpulan

Berdasarkan hasil analisis dan pembahasan yang telah dilakukan sebelumnya maka dapat disimpulkan sebagai berikut :

1. Bedasarkan uji performansi menggunakan parameter performansi *makespan* rata-rata, EI, RE, dan *run time* rata-rata didapat hasil :
   a. Berdasarkan *makespan* rata-rata, performansi terbaik dengan kombinasi 8 *jobs* 3 *machines,* kombinasi 13 *jobs* 3 *machines,* maupun kombinasi 44 *jobs* 34 *machines* yaitu metode heuristik algoritma *tabu search.* Hal tersebut dapat dilihat dari nilai *makespan* rata-rata terkecil yang dihasilkan oleh metode heuristik algoritma *tabu search* dibandingkan dengan dua metode heuristik lainnya.
   b. Berdasarkan hasil perhitungan nilai EI pada kombinasi 8 *jobs* 3 *machines*, kombinasi 13 *jobs* 3 *machines*, maupun kombinasi 44 *jobs* 34 *machines*, metode heuristik algoritma *tabu search* merupakan metode terbaik. Hal tersebut dilihat dari perhitungan EI antara metode heuristik algoritma *pour* dengan metode heuristik algortima *tabu search* didapatkan nilai EI > 1 dan antara metode heuristik algoritma NST dengan metode heuristik algoritma *tabu search* didapatkan nilai EI > 1.

c. Berdasarkan hasil perhitungan nilai RE pada kombinasi 8 *jobs* 3 *machines,* kombinasi 13 *jobs* 3 *machines,* maupun kombinasi 44 *jobs* 34 *machines,* didapat hasil bahwa metode heuristik algoritma *tabu search* sebagai metode terbaik memiliki hasil nilai RE terhadap metode heuristik algoritma *pour* dan metode heuristik algoritma NST.

d. Berdasarkan hasil analisis *run time* rata-rata, metode heuristik algoritma NST memiliki nilai *run time* yang paling cepat yaitu sebesar 0.1134 detik dengan kombinasi 8 *jobs* 3 *machines,* 0.143 detik dengan kombinasi 13 *jobs* 3 *machines,* dan 1.817 detik dengan kombinasi 44 *jobs* 34 *machines*. Sedangkan, metode heuristik algoritma *tabu search* memiliki nilai *run time* yang paling lama yaitu 4.851 detik dengan kombinasi 8 *jobs* 3 *machines,* 10.506 detik dengan kombinasi 13 *jobs* 3 *machines,* dan 111.889 detik dengan kombinasi 44 *jobs* 34 *machines*. Meskipun metode heuristik algoritma *tabu search* memiliki nilai *run time* paling lama, namun nilai *run time* tersebut masih dapat ditoleransi.

2. Dalam penelitian ini didapatkan hasil bahwa metode heuristik algoritma *tabu search* merupakan metode terbaik dalam penjadwalan *flow shop* n *job* m *machine* untuk meminimalkan *makespan,* dibandingkan dengan metode heuristik algoritma *pour* dan algoritma NST dalam permasalahan kombinasi 8 *jobs* 3 *machines,* kombinasi 13 *jobs* 3 *machines,* dan kombinasi 44 *jobs* 34 *machines*.

5.2. Saran

Penelitian ini masih memiliki berbagai batasan, oleh sebab itu saran yang dapat diberikan sebagai berikut :

1. Untuk penelitian selanjutnya perlu dilakukan eksperimen studi komputasi dengan jenis penjadwalan *job shop*.
2. Untuk penelitian selanjutnya perlu dilakukan eksperimen studi komputasi tidak hanya berfokus pada satu kriteria penjadwalan produksi yang ada, namun bisa difokuskan agar metode penjadwalan produksi yang dikembangkan dapat memenuhi beberapa kriteria sekaligus.
3. Untuk penelitian selanjutnya perlu dilakukan eksperimen studi komputasi metode heuristik yang lain untuk mendapatkan metode penjadwalan *flow shop* yang lebih baik. Metode-metode metaheuristik tersebut antara lain algoritma *harmony search*, *simulated annealing*, *ant colony*, *particle swarm optimization*, serta algoritma metaheuristik lain.

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LAMPIRAN

Lampiran 1. Data *Processing Time* Permasalahan Penjadwalan Kombinasi 8 *Jobs* 3 *Machines* (*Small Size*) sebanyak 100 *Run*

Number Of Run																				
1-34									**35-68**								**69-100**			
1	datarandom_8x3_1								35	datarandom_8x3_35							69	datarandom_8x3_69		
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	67	96	27	31	99	26	28	32	M1	67	10	39	73	39	53	4	12	M1	27	76	47	83	98	30	62	82
	M2	62	22	80	31	78	35	45	75	M2	15	54	9	74	14	41	17	87	M2	34	69	67	39	34	58	94	91
	M3	56	10	74	33	51	14	76	26	M3	81	76	33	19	33	45	91	21	M3	33	74	68	9	2	57	76	44
2	datarandom_8x3_2									36	datarandom_8x3_36								70	datarandom_8x3_70							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	78	50	99	69	16	81	72	51	M1	75	59	88	88	6	38	23	84	M1	89	9	74	29	36	42	22	94
	M2	32	70	18	8	10	84	55	78	M2	72	21	33	53	62	8	14	32	M2	73	37	59	55	44	65	57	34
	M3	32	28	95	50	4	76	39	69	M3	15	81	56	74	77	94	38	5	M3	97	33	87	93	96	46	79	5
3	datarandom_8x3_3									37	datarandom_8x3_37								71	datarandom_8x3_71							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	83	35	12	58	7	7	20	48	M1	72	46	33	72	19	44	11	41	M1	97	93	11	24	6	18	90	5
	M2	39	49	18	40	46	30	28	91	M2	2	49	69	55	27	74	56	98	M2	68	17	32	78	69	64	49	90
	M3	69	43	56	99	37	32	31	97	M3	52	42	34	21	78	61	73	88	M3	36	32	75	45	71	63	40	44
4	datarandom_8x3_4									38	datarandom_8x3_38								72	datarandom_8x3_72							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	26	11	59	33	49	5	54	8	M1	75	52	91	10	93	49	18	75	M1	22	62	5	67	75	76	66	27
	M2	80	87	3	44	20	68	97	3	M2	7	55	29	71	9	45	75	10	M2	78	69	25	29	9	67	29	79
	M3	97	60	5	61	99	33	76	18	M3	79	65	38	57	64	93	95	80	M3	70	16	75	66	44	36	36	41
5	datarandom_8x3_5									39	datarandom_8x3_39								73	datarandom_8x3_73							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	2	70	94	17	98	24	86	31	M1	31	68	91	48	46	85	28	15	M1	57	29	15	26	63	35	52	33
	M2	63	54	79	2	15	96	14	37	M2	50	30	94	68	46	23	88	77	M2	34	50	31	56	52	14	70	21
	M3	13	70	24	24	85	6	70	37	M3	60	22	12	18	14	76	19	35	M3	13	27	25	47	42	4	95	97

6

datarandom_8x3_6

	J1	J2	J3	J4	J5	J6	J7	J8
M1	75	24	8	39	32	72	94	95
M2	8	23	40	48	14	7	81	26
M3	30	51	23	16	41	48	12	36

40

datarandom_8x3_40

	J1	J2	J3	J4	J5	J6	J7	J8
M1	40	41	54	63	77	9	79	8
M2	29	56	37	80	77	42	28	34
M3	81	56	87	20	27	52	47	4

74

datarandom_8x3_74

	J1	J2	J3	J4	J5	J6	J7	J8
M1	61	99	21	49	48	77	74	65
M2	11	83	45	91	32	64	8	20
M3	13	57	39	96	83	80	47	91

7

datarandom_8x3_7

	J1	J2	J3	J4	J5	J6	J7	J8
M1	20	53	84	87	63	91	25	74
M2	92	75	43	90	43	79	32	48
M3	56	90	22	19	97	92	54	10

41

datarandom_8x3_41

	J1	J2	J3	J4	J5	J6	J7	J8
M1	77	89	58	42	27	75	29	27
M2	93	16	26	92	68	62	73	51
M3	7	23	38	7	61	84	58	97

75

datarandom_8x3_75

	J1	J2	J3	J4	J5	J6	J7	J8
M1	66	80	23	48	94	83	52	81
M2	20	90	14	77	77	48	49	98
M3	93	51	35	29	16	68	78	69

8

datarandom_8x3_8

	J1	J2	J3	J4	J5	J6	J7	J8
M1	7	32	23	66	49	89	96	82
M2	11	7	42	51	22	69	62	59
M3	24	84	68	68	4	16	14	11

42

datarandom_8x3_42

	J1	J2	J3	J4	J5	J6	J7	J8
M1	21	8	75	91	67	74	81	95
M2	46	78	60	24	30	27	18	23
M3	98	66	48	50	84	92	58	74

76

datarandom_8x3_76

	J1	J2	J3	J4	J5	J6	J7	J8
M1	92	77	62	78	44	19	96	10
M2	41	21	31	85	44	90	77	46
M3	27	64	39	47	5	51	94	70

9

datarandom_8x3_9

	J1	J2	J3	J4	J5	J6	J7	J8
M1	66	61	12	78	85	21	46	14
M2	58	99	68	5	52	26	65	35
M3	81	64	49	17	4	58	44	98

43

datarandom_8x3_43

	J1	J2	J3	J4	J5	J6	J7	J8
M1	32	71	82	81	28	95	62	22
M2	91	63	20	50	68	26	80	29
M3	10	21	91	6	90	46	76	39

77

datarandom_8x3_77

	J1	J2	J3	J4	J5	J6	J7	J8
M1	71	18	15	85	11	73	88	94
M2	56	28	68	71	5	76	6	3
M3	9	46	88	24	60	37	99	52

10

datarandom_8x3_10

	J1	J2	J3	J4	J5	J6	J7	J8
M1	12	26	68	64	29	81	46	94
M2	45	84	24	82	33	94	84	2
M3	88	61	39	75	99	78	42	40

44

datarandom_8x3_44

	J1	J2	J3	J4	J5	J6	J7	J8
M1	71	30	23	84	7	71	34	65
M2	41	79	5	9	74	78	58	13
M3	45	15	99	97	31	35	25	71

78

datarandom_8x3_78

	J1	J2	J3	J4	J5	J6	J7	J8
M1	71	3	80	78	49	95	7	89
M2	57	36	66	36	90	21	64	25
M3	10	14	64	84	78	70	41	91

11

datarandom_8x3_11

	J1	J2	J3	J4	J5	J6	J7	J8
M1	38	35	62	2	37	10	48	65
M2	3	19	8	83	18	88	60	13
M3	51	88	30	51	43	20	32	90

45

datarandom_8x3_45

	J1	J2	J3	J4	J5	J6	J7	J8
M1	88	57	74	73	29	64	66	27
M2	68	95	76	8	55	65	74	49
M3	70	9	86	40	9	71	85	25

79

datarandom_8x3_79

	J1	J2	J3	J4	J5	J6	J7	J8
M1	52	82	7	69	49	62	12	72
M2	93	51	49	97	34	66	24	72
M3	36	50	12	20	40	93	68	86

12	datarandom_8x3_12 J1 J2 J3 J4 J5 J6 J7 J8 M1 95 70 94 51 68 35 71 20 M2 15 54 48 79 49 80 61 26 M3 5 49 37 16 9 11 31 55	46	datarandom_8x3_46 J1 J2 J3 J4 J5 J6 J7 J8 M1 28 11 55 40 53 75 2 86 M2 40 82 45 90 40 32 76 56 M3 10 61 86 17 88 85 70 77	80	datarandom_8x3_80 J1 J2 J3 J4 J5 J6 J7 J8 M1 80 80 17 56 52 44 90 65 M2 20 12 57 39 62 80 60 9 M3 54 34 7 54 29 68 45 34
13	datarandom_8x3_13 J1 J2 J3 J4 J5 J6 J7 J8 M1 6 89 26 39 40 7 66 40 M2 25 36 55 8 21 4 42 39 M3 54 6 74 23 48 77 59 96	47	datarandom_8x3_47 J1 J2 J3 J4 J5 J6 J7 J8 M1 82 50 60 67 11 79 9 97 M2 56 78 67 21 36 64 56 34 M3 76 82 55 7 40 13 62 37	81	datarandom_8x3_81 J1 J2 J3 J4 J5 J6 J7 J8 M1 21 96 78 27 71 66 46 99 M2 62 95 62 46 30 58 10 67 M3 28 43 11 25 55 71 24 72
14	datarandom_8x3_14 J1 J2 J3 J4 J5 J6 J7 J8 M1 19 2 83 40 73 76 97 63 M2 65 93 10 27 99 81 5 7 M3 90 45 95 10 66 10 71 46	48	datarandom_8x3_48 J1 J2 J3 J4 J5 J6 J7 J8 M1 92 64 95 56 69 83 18 95 M2 82 64 72 92 99 18 10 2 M3 74 71 7 62 85 19 73 61	82	datarandom_8x3_82 J1 J2 J3 J4 J5 J6 J7 J8 M1 74 92 56 90 90 3 64 38 M2 37 9 99 64 98 94 65 75 M3 42 35 61 78 23 83 9 74
15	datarandom_8x3_15 J1 J2 J3 J4 J5 J6 J7 J8 M1 75 38 51 54 50 29 48 80 M2 16 81 30 75 70 16 82 63 M3 75 29 33 70 80 62 25 96	49	datarandom_8x3_49 J1 J2 J3 J4 J5 J6 J7 J8 M1 34 47 16 84 65 34 35 91 M2 17 35 55 39 69 61 40 31 M3 37 50 40 87 53 70 17 54	83	datarandom_8x3_83 J1 J2 J3 J4 J5 J6 J7 J8 M1 80 7 39 91 97 40 47 86 M2 40 18 82 20 66 17 75 79 M3 29 44 75 94 68 26 11 34
16	datarandom_8x3_16 J1 J2 J3 J4 J5 J6 J7 J8 M1 78 58 95 51 9 98 94 38 M2 63 87 62 95 76 21 91 52 M3 16 20 98 79 80 52 62 47	50	datarandom_8x3_50 J1 J2 J3 J4 J5 J6 J7 J8 M1 20 2 99 61 16 44 49 24 M2 74 81 86 53 34 81 69 68 M3 85 38 84 35 9 56 4 20	84	datarandom_8x3_84 J1 J2 J3 J4 J5 J6 J7 J8 M1 45 82 42 93 61 60 91 40 M2 80 94 59 61 52 11 92 3 M3 9 73 67 66 77 18 99 87
17	datarandom_8x3_17 J1 J2 J3 J4 J5 J6 J7 J8 M1 49 83 51 36 66 52 89 72 M2 98 98 58 3 21 55 76 21 M3 91 35 84 87 15 72 6 84	51	datarandom_8x3_51 J1 J2 J3 J4 J5 J6 J7 J8 M1 51 15 39 33 7 56 22 61 M2 72 38 18 56 25 2 47 62 M3 33 89 85 48 52 64 53 32	85	datarandom_8x3_85 J1 J2 J3 J4 J5 J6 J7 J8 M1 54 46 10 8 93 74 18 29 M2 46 11 71 30 43 27 74 98 M3 5 9 64 69 39 82 95 22

18	datarandom_8x3_18								52	datarandom_8x3_52								86	datarandom_8x3_86							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	33	30	65	30	90	64	11	32	M1	92	43	8	45	38	34	24	15	M1	80	17	94	46	66	21	56	4
	M2	37	64	13	37	27	53	40	71	M2	58	7	55	86	81	52	62	33	M2	49	69	77	2	5	89	36	29
	M3	57	8	64	86	40	69	84	63	M3	86	43	23	54	22	79	44	94	M3	85	38	55	34	98	10	9	79
19	datarandom_8x3_19									53	datarandom_8x3_53								87	datarandom_8x3_87							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	60	50	62	65	98	63	55	38	M1	74	60	80	8	20	10	33	99	M1	15	66	82	14	98	8	30	33
	M2	7	37	31	80	84	24	66	45	M2	17	18	55	37	72	46	6	32	M2	43	45	48	74	49	23	55	43
	M3	55	5	74	25	6	89	78	34	M3	75	99	9	56	96	89	91	20	M3	83	31	83	63	72	47	30	77
20	datarandom_8x3_20									54	datarandom_8x3_54								88	datarandom_8x3_88							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	4	54	79	72	50	16	59	60	M1	5	48	91	21	94	50	52	96	M1	86	90	94	83	54	55	97	8
	M2	52	22	10	71	47	47	62	31	M2	46	9	69	50	6	36	75	30	M2	55	99	60	63	43	81	42	9
	M3	29	98	67	71	22	96	77	10	M3	9	4	96	11	43	10	69	68	M3	2	58	16	24	11	3	58	66
21	datarandom_8x3_21									55	datarandom_8x3_55								89	datarandom_8x3_89							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	4	14	24	28	15	78	96	42	M1	2	18	30	95	93	45	15	87	M1	35	81	2	15	63	16	24	43
	M2	11	36	75	24	18	6	35	28	M2	95	24	45	66	21	8	96	11	M2	55	61	39	67	5	36	76	25
	M3	79	40	8	29	97	43	40	34	M3	25	53	70	90	11	65	84	22	M3	43	4	23	74	3	90	15	96
22	datarandom_8x3_22									56	datarandom_8x3_56								90	datarandom_8x3_90							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	50	84	92	32	77	39	12	31	M1	15	40	60	31	90	26	71	24	M1	71	74	21	33	71	58	60	44
	M2	64	96	79	69	56	71	59	22	M2	58	34	59	53	19	23	73	77	M2	95	35	3	89	42	28	81	16
	M3	68	92	73	35	43	72	27	4	M3	65	27	97	38	97	15	19	76	M3	31	94	10	94	54	62	14	99
23	datarandom_8x3_23									57	datarandom_8x3_57								91	datarandom_8x3_91							
		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8		J1	J2	J3	J4	J5	J6	J7	J8
	M1	32	20	33	46	19	24	58	32	M1	69	20	48	31	33	77	6	87	M1	13	25	23	13	84	63	48	8
	M2	35	3	58	27	77	34	5	51	M2	13	41	34	87	33	14	9	14	M2	24	27	14	17	37	13	82	60
	M3	62	64	84	22	86	89	9	55	M3	39	68	62	77	13	14	96	65	M3	74	47	86	30	6	80	76	45

24	datarandom_8x3_24 J1 J2 J3 J4 J5 J6 J7 J8 M1 84 65 64 89 28 93 54 55 M2 34 20 7 96 14 46 90 92 M3 93 83 11 53 29 67 66 93	58	datarandom_8x3_58 J1 J2 J3 J4 J5 J6 J7 J8 M1 22 92 70 15 56 32 43 10 M2 55 20 61 77 89 59 46 70 M3 96 98 60 91 80 55 74 41	92	datarandom_8x3_92 J1 J2 J3 J4 J5 J6 J7 J8 M1 31 56 7 54 36 54 36 91 M2 11 72 27 27 66 96 22 52 M3 43 80 78 67 86 66 51 87
25	datarandom_8x3_25 J1 J2 J3 J4 J5 J6 J7 J8 M1 2 83 65 25 10 40 16 67 M2 85 53 34 55 74 94 53 91 M3 86 23 99 66 87 76 57 24	59	datarandom_8x3_59 J1 J2 J3 J4 J5 J6 J7 J8 M1 33 21 35 21 20 19 12 59 M2 79 5 31 12 89 50 54 96 M3 7 17 56 28 24 36 34 93	93	datarandom_8x3_93 J1 J2 J3 J4 J5 J6 J7 J8 M1 33 32 75 54 27 81 85 25 M2 40 78 25 25 16 85 64 8 M3 67 48 80 36 88 37 8 60
26	datarandom_8x3_26 J1 J2 J3 J4 J5 J6 J7 J8 M1 13 40 41 89 95 40 64 64 M2 49 14 96 93 84 45 20 54 M3 58 22 82 34 13 34 89 35	60	datarandom_8x3_60 J1 J2 J3 J4 J5 J6 J7 J8 M1 15 71 88 29 91 66 86 28 M2 56 63 57 29 71 15 24 55 M3 66 40 19 88 61 16 55 40	94	datarandom_8x3_94 J1 J2 J3 J4 J5 J6 J7 J8 M1 63 89 58 47 16 18 89 26 M2 84 15 89 98 28 58 38 25 M3 78 84 86 68 57 52 37 83
27	datarandom_8x3_27 J1 J2 J3 J4 J5 J6 J7 J8 M1 39 15 92 34 80 21 17 43 M2 63 5 75 97 11 45 53 75 M3 65 93 63 55 64 60 40 63	61	datarandom_8x3_61 J1 J2 J3 J4 J5 J6 J7 J8 M1 53 35 63 28 39 99 46 67 M2 19 34 39 23 88 99 39 94 M3 84 23 41 50 50 97 18 93	95	datarandom_8x3_95 J1 J2 J3 J4 J5 J6 J7 J8 M1 58 33 82 92 98 33 90 23 M2 31 50 24 31 63 5 28 98 M3 2 56 58 84 43 21 61 90
28	datarandom_8x3_28 J1 J2 J3 J4 J5 J6 J7 J8 M1 93 57 64 98 93 24 63 95 M2 34 83 74 84 84 59 24 5 M3 20 87 68 74 86 13 10 65	62	datarandom_8x3_62 J1 J2 J3 J4 J5 J6 J7 J8 M1 9 79 52 77 81 10 35 91 M2 15 44 89 36 4 74 47 22 M3 76 94 57 21 97 40 36 9	96	datarandom_8x3_96 J1 J2 J3 J4 J5 J6 J7 J8 M1 5 47 46 24 19 70 83 43 M2 35 75 74 69 4 26 69 30 M3 57 23 61 9 53 52 73 37
29	datarandom_8x3_29 J1 J2 J3 J4 J5 J6 J7 J8 M1 26 16 60 69 49 81 53 60 M2 49 3 70 82 95 23 6 49 M3 2 61 27 81 9 16 36 66	63	datarandom_8x3_63 J1 J2 J3 J4 J5 J6 J7 J8 M1 81 3 63 98 59 41 89 42 M2 15 27 79 23 97 50 39 57 M3 11 28 61 18 94 64 50 63	97	datarandom_8x3_97 J1 J2 J3 J4 J5 J6 J7 J8 M1 72 73 98 24 96 87 54 39 M2 10 96 5 90 29 79 57 53 M3 21 17 32 35 26 30 51 79

30

datarandom_8x3_30

	J1	J2	J3	J4	J5	J6	J7	J8
M1	66	44	57	56	22	85	66	15
M2	77	95	7	97	8	21	58	73
M3	70	18	37	27	79	12	16	7

31

datarandom_8x3_31

	J1	J2	J3	J4	J5	J6	J7	J8
M1	32	8	64	63	42	82	77	79
M2	69	84	99	80	11	36	73	73
M3	86	69	3	63	34	8	76	45

32

datarandom_8x3_32

	J1	J2	J3	J4	J5	J6	J7	J8
M1	29	86	62	25	73	19	59	79
M2	28	56	15	77	99	79	92	7
M3	28	48	38	48	54	5	23	35

33

datarandom_8x3_33

	J1	J2	J3	J4	J5	J6	J7	J8
M1	58	54	79	79	92	21	73	28
M2	5	7	13	75	45	23	66	19
M3	49	66	90	18	8	5	87	54

34

datarandom_8x3_34

	J1	J2	J3	J4	J5	J6	J7	J8
M1	26	21	90	31	49	37	82	63
M2	25	21	61	7	50	95	30	36
M3	77	81	5	14	30	77	4	45

64

datarandom_8x3_64

	J1	J2	J3	J4	J5	J6	J7	J8
M1	31	93	98	84	93	77	14	97
M2	60	41	55	2	49	58	43	79
M3	60	63	76	12	79	68	6	65

65

datarandom_8x3_65

	J1	J2	J3	J4	J5	J6	J7	J8
M1	43	47	83	32	89	93	88	18
M2	27	13	22	52	49	97	84	44
M3	80	25	47	90	65	72	32	69

66

datarandom_8x3_66

	J1	J2	J3	J4	J5	J6	J7	J8
M1	91	33	59	69	45	59	90	53
M2	89	29	42	36	84	62	98	51
M3	83	93	7	66	12	21	48	31

67

datarandom_8x3_67

	J1	J2	J3	J4	J5	J6	J7	J8
M1	20	74	99	19	58	41	51	47
M2	43	21	50	37	2	36	26	75
M3	42	35	42	16	86	17	27	89

68

datarandom_8x3_68

	J1	J2	J3	J4	J5	J6	J7	J8
M1	53	31	18	57	71	94	85	97
M2	33	18	38	8	2	11	95	58
M3	38	79	54	41	20	32	83	13

98

datarandom_8x3_98

	J1	J2	J3	J4	J5	J6	J7	J8
M1	32	76	78	59	7	86	10	14
M2	6	62	76	61	80	31	88	57
M3	92	10	41	45	50	89	16	54

99

datarandom_8x3_99

	J1	J2	J3	J4	J5	J6	J7	J8
M1	98	56	42	35	87	78	44	45
M2	83	37	25	94	6	66	57	99
M3	62	23	13	49	39	63	17	23

100

datarandom_8x3_100

	J1	J2	J3	J4	J5	J6	J7	J8
M1	79	94	81	2	27	76	52	99
M2	19	7	70	53	15	88	63	91
M3	74	9	2	14	34	90	23	63

Lampiran 2. Data *Processing Time* Permasalahan Penjadwalan Kombinasi 13 *Jobs* 3 *Machines* (*Medium Size*) sebanyak 100 *Run*

Number Of Run																										
1-50															**51-100**												
1	datarandom_13x3_1														51	datarandom_13x3_51												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13			J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	94	95	64	88	36	79	8	49	85	8	39	83	5		M1	62	88	80	46	25	13	79	77	73	21	10	78	51
	M2	64	18	27	82	7	81	49	96	13	96	22	41	18		M2	29	61	68	54	58	54	68	35	10	94	31	71	56
	M3	25	96	86	52	75	17	18	39	50	4	31	71	60		M3	29	70	44	35	76	4	9	79	87	92	25	94	34
2	datarandom_13x3_2														52	datarandom_13x3_52												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13			J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	83	91	85	90	45	68	20	70	19	84	34	22	99		M1	11	3	33	3	24	92	16	11	77	84	22	91	54
	M2	54	27	55	31	66	48	90	22	57	55	41	23	8		M2	87	40	66	8	83	92	30	77	15	12	66	83	14
	M3	12	12	98	95	53	11	28	54	60	89	50	54	10		M3	94	17	72	31	11	58	35	96	60	57	14	20	33
3	datarandom_13x3_3														53	datarandom_13x3_53												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13			J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	82	48	13	58	42	76	82	60	68	64	32	37	8		M1	54	41	94	97	92	51	39	92	45	5	2	18	98
	M2	52	56	60	77	20	26	39	94	6	45	55	20	13		M2	42	3	33	68	24	73	42	80	4	62	31	57	29
	M3	32	24	34	73	60	19	83	73	88	70	64	47	23		M3	84	30	72	29	85	53	85	27	64	17	33	49	14
4	datarandom_13x3_4														54	datarandom_13x3_54												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13			J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	42	94	60	65	40	97	33	10	43	70	92	43	89		M1	14	46	91	11	80	37	93	71	93	15	33	8	96
	M2	29	29	95	28	42	64	38	26	17	39	77	41	96		M2	43	44	39	71	43	58	62	65	88	32	79	65	26
	M3	9	89	39	42	27	76	68	12	15	89	13	61	54		M3	37	68	81	88	53	42	29	44	84	7	61	82	70
5	datarandom_13x3_5														55	datarandom_13x3_55												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13			J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	14	92	14	57	52	6	96	33	74	80	57	15	20		M1	53	19	26	61	95	71	59	93	81	36	84	68	93
	M2	17	26	11	84	99	57	24	38	7	42	2	22	44		M2	19	64	77	36	16	21	7	82	79	10	44	21	40
	M3	24	39	5	55	2	61	82	65	32	83	32	66	60		M3	29	32	36	19	77	35	71	38	17	3	17	4	80

6

datarandom_13x3_6

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	21	74	59	93	35	80	65	64	13	65	89	7	22
M2	69	32	9	55	34	75	9	95	16	47	82	91	17
M3	58	76	65	60	46	89	66	86	66	36	93	89	22

7

datarandom_13x3_7

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	36	81	33	66	30	17	31	41	12	85	50	15	91
M2	84	96	51	30	89	31	91	93	90	27	5	15	19
M3	83	3	19	71	13	79	25	94	80	81	20	65	49

8

datarandom_13x3_8

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	33	17	69	23	34	50	19	82	80	2	2	45	92
M2	80	52	31	39	13	17	36	41	90	34	93	98	27
M3	78	46	61	68	73	95	29	55	45	65	71	31	82

9

datarandom_13x3_9

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	99	89	3	56	76	93	2	46	19	87	37	32	87
M2	47	50	88	22	27	9	7	49	57	54	58	70	84
M3	10	16	7	3	98	49	24	79	81	21	92	87	77

10

datarandom_13x3_10

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	3	69	46	22	61	3	96	60	18	3	3	38	3
M2	41	43	55	31	40	93	3	83	95	34	65	15	47
M3	63	89	44	20	90	36	94	54	66	79	96	11	53

11

datarandom_13x3_11

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	17	85	34	46	6	83	37	57	2	57	43	28	90
M2	90	60	26	55	14	64	74	37	84	55	83	10	45
M3	19	67	70	23	42	97	82	8	63	45	16	81	27

56

datarandom_13x3_56

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	53	68	81	23	62	47	19	82	80	51	34	91	61
M2	87	9	17	42	16	66	80	29	68	12	85	23	39
M3	18	64	37	43	74	84	49	46	7	96	73	4	65

57

datarandom_13x3_57

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	89	9	62	18	71	44	25	39	16	74	25	79	4
M2	75	76	50	21	11	71	71	2	95	99	59	98	86
M3	55	86	51	18	89	47	20	11	78	91	17	37	71

58

datarandom_13x3_58

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	73	67	84	69	70	86	49	54	77	9	60	46	5
M2	68	12	10	65	7	41	49	84	70	75	18	54	4
M3	49	89	23	75	28	4	84	41	86	62	13	13	55

59

datarandom_13x3_59

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	27	73	59	24	97	69	36	85	65	45	66	54	55
M2	97	54	40	25	94	41	25	41	79	77	29	5	88
M3	33	13	11	80	67	29	70	35	86	13	62	47	46

60

datarandom_13x3_60

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	61	67	94	81	60	82	53	59	46	13	10	44	85
M2	68	59	94	48	75	16	56	29	20	40	92	43	53
M3	26	85	36	70	31	40	46	62	16	11	82	21	34

61

datarandom_13x3_61

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	17	26	44	84	89	48	16	99	24	22	70	25	42
M2	47	46	65	81	35	25	44	24	40	89	66	39	97
M3	87	34	53	77	41	37	93	82	8	76	44	54	45

12

datarandom_13x3_12

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	80	49	2	96	87	54	71	50	87	4	10	32	12
M2	48	44	41	2	80	51	57	81	28	15	28	40	29
M3	18	86	94	39	99	5	61	67	17	71	19	77	85

13

datarandom_13x3_13

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	27	49	83	99	50	41	76	40	28	5	41	29	75
M2	43	75	57	46	15	85	40	70	53	7	52	16	35
M3	44	26	41	51	23	50	9	63	38	7	74	83	31

14

datarandom_13x3_14

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	54	7	78	50	29	58	50	51	82	35	47	15	60
M2	84	15	64	43	16	20	86	14	60	33	81	37	76
M3	64	53	78	33	63	72	85	88	20	61	18	3	54

15

datarandom_13x3_15

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	93	45	75	98	3	70	58	83	50	7	28	77	97
M2	15	45	94	33	48	20	57	70	72	75	46	27	45
M3	16	59	48	13	87	63	21	10	19	72	80	74	24

16

datarandom_13x3_16

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	3	47	7	24	65	34	84	68	89	36	47	46	63
M2	66	16	30	58	89	22	11	22	40	79	61	60	87
M3	95	73	87	10	81	74	11	36	31	24	30	84	48

17

datarandom_13x3_17

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	70	78	57	12	56	85	52	59	45	78	53	88	26
M2	69	74	91	84	43	8	86	55	88	39	11	31	67
M3	66	27	62	72	27	44	23	50	6	89	53	76	8

62

datarandom_13x3_62

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	34	35	3	72	22	17	41	66	88	66	70	63	75
M2	47	92	77	52	7	84	12	49	18	39	34	37	92
M3	46	14	59	71	22	37	29	5	85	98	44	15	9

63

datarandom_13x3_63

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	82	56	47	37	81	95	46	60	75	71	57	88	94
M2	29	37	43	23	15	52	3	82	69	42	76	42	76
M3	99	55	63	10	91	2	65	76	95	32	97	4	56

64

datarandom_13x3_64

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	99	79	19	58	2	82	31	20	41	54	51	95	73
M2	33	89	45	62	95	23	79	58	12	73	75	18	34
M3	38	69	58	84	82	34	85	61	14	99	47	36	34

65

datarandom_13x3_65

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	72	75	36	90	89	60	60	60	54	58	42	18	43
M2	33	69	67	61	43	68	65	91	3	41	91	2	32
M3	12	26	42	82	3	33	86	25	52	32	66	64	15

66

datarandom_13x3_66

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	6	59	30	59	22	15	75	28	66	14	22	20	44
M2	5	9	45	78	5	54	98	67	89	65	73	42	12
M3	41	41	8	68	64	6	36	5	50	92	7	53	41

67

datarandom_13x3_67

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	83	7	14	92	97	72	76	54	76	78	96	38	75
M2	57	93	92	48	99	5	25	12	98	49	35	35	50
M3	36	97	53	16	99	15	59	20	78	63	69	63	46

18	datarandom_13x3_18												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	64	2	35	74	85	23	94	65	42	29	76	27	66
	M2	67	7	60	5	50	51	43	86	35	97	35	15	45
	M3	28	44	52	57	44	60	5	64	15	28	72	22	45

19	datarandom_13x3_19												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	84	97	94	23	24	42	59	99	38	94	36	45	4
	M2	38	61	83	99	55	64	32	40	94	98	84	84	75
	M3	14	59	13	72	3	44	27	48	51	36	83	48	73

20	datarandom_13x3_20												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	28	13	42	8	20	71	55	85	23	8	75	33	2
	M2	79	76	42	39	21	11	53	84	33	46	3	44	77
	M3	27	7	74	61	82	86	41	20	88	31	35	38	31

21	datarandom_13x3_21												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	84	27	91	19	98	47	64	92	61	49	38	16	81
	M2	39	85	66	19	52	45	86	60	10	25	63	12	98
	M3	74	78	85	9	78	13	95	95	66	27	12	74	73

22	datarandom_13x3_22												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	57	2	68	2	99	73	23	79	4	14	15	34	4
	M2	23	48	46	18	16	25	53	5	16	82	43	97	8
	M3	27	6	23	86	93	75	6	92	18	39	97	70	31

23	datarandom_13x3_23												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	41	83	21	15	33	39	90	80	46	63	33	73	49
	M2	96	20	77	5	96	33	91	46	78	44	28	76	35
	M3	64	35	98	38	48	61	89	97	10	49	66	87	73

68	datarandom_13x3_68												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	2	4	40	17	43	3	99	66	28	4	55	19	49
	M2	48	26	28	37	54	73	59	52	22	81	66	82	67
	M3	72	44	9	15	16	38	59	80	73	26	25	64	32

69	datarandom_13x3_69												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	99	44	91	54	16	49	16	39	79	98	92	76	40
	M2	61	77	96	69	84	3	25	36	70	20	63	61	93
	M3	40	73	68	64	69	16	57	30	8	59	12	35	21

70	datarandom_13x3_70												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	86	22	53	66	93	34	58	11	36	71	81	39	48
	M2	27	56	64	45	63	29	82	65	52	53	27	20	45
	M3	48	78	79	57	38	60	37	33	16	27	87	63	29

71	datarandom_13x3_71												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	43	34	80	33	2	50	63	80	91	6	43	50	8
	M2	19	85	25	93	39	90	74	92	78	60	92	43	23
	M3	19	70	48	99	56	48	52	14	73	22	77	71	92

72	datarandom_13x3_72												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	5	10	95	19	88	8	26	64	44	4	10	5	26
	M2	38	78	97	27	43	19	84	4	27	98	69	28	85
	M3	21	53	7	66	59	90	8	75	64	35	33	75	37

73	datarandom_13x3_73												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	91	3	63	46	8	96	72	41	78	46	73	75	30
	M2	36	65	62	73	91	60	51	30	16	84	5	59	49
	M3	83	92	53	64	52	33	48	84	41	93	38	34	74

24

datarandom_13x3_24

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	30	82	66	47	4	9	48	67	72	96	38	8	50
M2	64	3	64	4	26	65	67	37	85	91	74	47	66
M3	82	89	13	85	63	49	54	6	19	32	7	92	23

25

datarandom_13x3_25

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	55	34	53	49	71	62	28	41	76	2	11	83	17
M2	20	11	60	40	42	46	17	74	47	33	11	10	3
M3	64	95	36	8	55	41	39	16	44	59	58	94	38

26

datarandom_13x3_26

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	10	49	22	71	44	32	10	29	28	43	51	15	40
M2	86	95	90	12	96	49	51	7	48	27	21	21	29
M3	73	47	62	19	70	66	6	31	18	77	83	72	11

27

datarandom_13x3_27

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	91	16	10	71	77	64	43	67	32	78	46	81	31
M2	92	69	46	34	39	28	20	21	4	79	27	79	82
M3	22	13	87	93	2	28	93	22	81	13	80	34	13

28

datarandom_13x3_28

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	29	36	28	48	8	81	5	89	52	20	93	33	43
M2	20	56	78	75	22	37	34	52	46	8	61	5	80
M3	8	32	65	69	18	32	81	30	9	21	27	88	18

29

datarandom_13x3_29

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	8	4	39	51	36	97	54	49	54	86	68	90	26
M2	52	43	52	28	40	18	23	15	73	14	86	90	27
M3	4	21	95	93	67	51	30	90	93	85	31	97	2

74

datarandom_13x3_74

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	29	78	71	84	35	38	57	40	8	70	14	87	18
M2	57	19	11	77	41	89	6	7	10	3	66	82	22
M3	53	21	9	72	12	74	72	33	32	7	49	29	96

75

datarandom_13x3_75

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	46	71	73	79	37	63	34	10	24	69	47	28	46
M2	84	38	89	19	90	44	4	20	35	87	61	43	20
M3	95	81	64	9	98	71	39	81	22	90	87	66	9

76

datarandom_13x3_76

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	15	32	10	50	13	68	68	83	53	62	11	59	44
M2	22	37	21	6	71	54	55	58	88	97	6	58	69
M3	21	84	91	38	4	69	10	35	91	51	34	85	55

77

datarandom_13x3_77

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	93	20	14	28	70	32	5	70	74	68	58	82	24
M2	58	17	4	91	38	93	67	16	82	72	85	17	3
M3	81	33	63	20	62	78	42	35	17	93	4	94	6

78

datarandom_13x3_78

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	52	31	96	38	18	54	73	75	7	59	49	19	69
M2	34	26	15	88	57	77	33	82	62	15	35	35	55
M3	8	38	9	96	85	59	10	16	76	32	97	13	9

79

datarandom_13x3_79

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	48	89	82	51	39	21	20	61	57	57	28	10	85
M2	61	62	94	19	8	75	62	89	46	82	60	8	11
M3	53	18	6	55	70	67	33	53	67	24	15	83	56

30

datarandom_13x3_30

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	41	85	18	88	36	15	81	86	25	60	74	79	42
M2	75	90	45	6	24	63	91	46	75	75	86	8	99
M3	55	38	30	8	41	70	15	25	28	91	64	98	14

31

datarandom_13x3_31

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	40	46	18	50	9	96	62	75	83	47	21	93	48
M2	93	28	68	44	99	47	91	38	67	81	59	98	36
M3	37	10	87	3	6	92	70	39	85	25	98	91	84

32

datarandom_13x3_32

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	40	84	89	64	89	22	61	25	8	90	46	32	37
M2	15	13	63	13	27	18	40	37	13	56	31	48	2
M3	22	21	2	59	25	97	37	81	42	55	12	78	76

33

datarandom_13x3_33

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	35	12	72	18	31	21	36	99	71	74	15	38	67
M2	65	20	64	97	43	17	91	29	31	77	65	43	85
M3	58	13	41	24	14	27	45	58	28	75	24	24	17

34

datarandom_13x3_34

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	65	57	25	71	57	9	2	38	12	62	5	14	46
M2	8	37	64	55	64	72	12	35	91	57	81	86	32
M3	46	79	85	60	9	21	98	29	95	76	97	73	24

35

datarandom_13x3_35

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	72	65	12	17	79	41	5	11	41	98	8	3	12
M2	4	56	81	88	18	48	64	49	99	49	54	53	60
M3	97	55	53	63	86	59	90	35	88	21	37	34	81

80

datarandom_13x3_80

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	45	49	68	25	67	73	50	17	91	24	13	27	98
M2	78	25	89	23	88	25	51	10	62	32	73	81	30
M3	35	83	32	53	54	41	13	50	7	61	92	85	8

81

datarandom_13x3_81

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	80	83	70	27	85	37	85	15	23	79	22	40	67
M2	89	47	99	44	25	15	71	89	99	91	91	8	97
M3	22	17	84	96	22	24	21	85	12	73	12	8	42

82

datarandom_13x3_82

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	8	63	60	71	74	5	41	34	24	65	31	54	74
M2	37	29	9	95	72	91	98	96	96	30	39	88	16
M3	90	90	67	45	52	2	61	30	30	17	86	59	96

83

datarandom_13x3_83

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	2	30	89	36	90	47	23	86	21	43	52	67	98
M2	53	43	66	60	66	3	82	64	93	11	25	3	23
M3	99	51	82	28	26	68	19	61	46	53	32	78	97

84

datarandom_13x3_84

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	81	36	70	47	38	5	6	43	77	49	89	82	24
M2	10	15	47	22	34	9	14	18	16	4	82	83	75
M3	61	80	88	18	45	90	24	37	30	23	17	85	43

85

datarandom_13x3_85

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	9	84	38	97	99	10	92	40	45	66	31	85	65
M2	51	98	63	99	58	56	56	78	95	8	89	18	59
M3	78	15	49	6	28	88	17	38	6	24	3	65	62

36	datarandom_13x3_36												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	92	88	89	87	63	21	76	71	53	27	15	95	69
	M2	11	50	80	51	20	20	20	92	31	10	70	71	83
	M3	37	32	88	39	70	18	25	2	20	89	87	50	65

37	datarandom_13x3_37												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	51	2	11	76	17	59	56	63	87	8	95	81	2
	M2	59	30	85	88	59	45	6	2	70	36	94	47	10
	M3	92	63	25	78	99	95	38	23	87	23	87	4	22

38	datarandom_13x3_38												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	98	17	92	34	34	18	51	64	45	15	33	43	83
	M2	72	17	27	11	56	54	85	75	97	67	32	63	83
	M3	94	77	82	87	73	75	71	53	92	69	16	48	94

39	datarandom_13x3_39												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	84	48	76	3	62	11	17	73	74	18	51	5	73
	M2	11	77	76	56	42	71	38	46	78	77	52	69	67
	M3	36	51	46	85	60	79	19	38	17	29	78	5	47

40	datarandom_13x3_40												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	59	87	81	82	5	67	82	55	28	55	20	77	58
	M2	40	14	7	40	80	82	15	76	2	17	13	76	90
	M3	94	60	72	12	40	45	29	12	76	86	96	25	95

41	datarandom_13x3_41												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	93	59	95	71	31	53	89	94	77	12	11	69	2
	M2	53	80	43	63	61	34	41	22	63	68	80	58	91
	M3	35	17	68	65	46	34	25	89	49	14	12	54	79

86	datarandom_13x3_86												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	41	25	69	36	81	35	56	80	39	75	36	80	68
	M2	72	23	43	79	7	7	47	59	34	48	50	40	44
	M3	79	4	96	89	81	94	75	70	63	17	93	3	10

87	datarandom_13x3_87												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	90	17	88	46	81	38	44	73	85	37	18	83	41
	M2	34	16	67	72	12	78	65	46	96	30	41	67	64
	M3	30	68	32	29	89	82	78	29	60	25	67	11	21

88	datarandom_13x3_88												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	72	83	71	79	74	58	36	61	41	62	96	12	78
	M2	49	60	2	43	65	14	74	53	53	79	57	56	25
	M3	88	45	49	51	57	21	49	62	82	92	5	48	5

89	datarandom_13x3_89												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	54	3	98	19	33	19	24	10	68	24	20	32	37
	M2	38	80	43	45	61	80	37	39	28	84	35	23	14
	M3	82	86	82	46	99	16	81	5	57	26	70	18	55

90	datarandom_13x3_90												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	77	7	25	25	24	64	88	76	86	11	66	80	57
	M2	79	71	58	85	50	12	36	94	24	40	61	66	39
	M3	99	66	44	99	62	33	50	44	83	52	94	11	33

91	datarandom_13x3_91												
		J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
	M1	51	18	65	89	24	6	51	4	66	8	60	29	77
	M2	58	52	36	69	95	39	77	10	32	37	57	76	56
	M3	18	25	72	13	16	47	44	98	84	37	5	17	59

42

datarandom_13x3_42

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	56	15	4	16	2	17	63	45	3	41	86	47	71
M2	36	27	34	68	93	57	47	14	55	38	71	95	56
M3	58	59	66	96	46	86	61	9	53	77	91	43	90

43

datarandom_13x3_43

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	31	75	27	38	31	14	58	86	91	86	16	58	25
M2	96	29	48	65	25	10	47	84	27	30	5	51	43
M3	98	11	70	51	81	16	18	27	51	99	8	39	16

44

datarandom_13x3_44

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	37	5	74	21	63	31	72	57	78	94	73	84	35
M2	24	86	24	78	80	54	13	2	28	32	24	64	90
M3	54	71	20	67	2	30	6	63	77	40	9	42	2

45

datarandom_13x3_45

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	6	24	27	52	40	46	67	62	9	41	82	39	36
M2	27	80	95	99	4	11	86	6	12	92	12	48	19
M3	39	87	38	39	46	47	22	9	37	23	30	66	76

46

datarandom_13x3_46

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	69	50	31	51	83	60	79	33	43	8	73	4	94
M2	78	8	79	24	28	46	90	52	35	55	43	18	8
M3	96	69	35	74	15	79	11	19	20	12	24	96	37

47

datarandom_13x3_47

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	47	84	14	23	64	31	75	14	41	15	24	60	18
M2	29	5	65	18	13	18	22	3	85	86	17	26	60
M3	95	32	91	20	98	43	28	31	36	39	13	61	20

92

datarandom_13x3_92

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	78	59	51	97	38	45	6	88	41	63	31	91	44
M2	65	88	35	26	42	5	28	99	58	48	76	46	39
M3	19	54	75	80	50	48	82	48	56	15	19	71	23

93

datarandom_13x3_93

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	27	4	75	73	81	31	26	81	56	23	39	65	90
M2	66	74	67	62	4	86	5	82	82	58	16	75	74
M3	68	92	87	59	86	68	91	23	70	14	59	49	77

94

datarandom_13x3_94

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	15	78	36	2	83	88	8	8	87	84	13	99	82
M2	64	72	62	15	13	54	38	52	36	33	93	13	25
M3	24	61	59	51	27	77	33	49	63	44	62	37	92

95

datarandom_13x3_95

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	85	32	62	86	15	67	27	7	35	85	25	42	52
M2	42	91	66	71	51	32	13	40	73	15	50	65	21
M3	56	2	24	47	50	85	78	95	69	91	84	61	28

96

datarandom_13x3_96

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	92	30	60	58	30	34	55	19	52	77	93	48	86
M2	49	55	70	88	82	57	20	8	36	92	17	73	52
M3	38	87	15	28	63	40	89	52	31	96	92	93	89

97

datarandom_13x3_97

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	33	9	47	99	54	38	61	27	69	72	56	53	41
M2	67	44	47	56	98	97	24	52	51	94	83	74	46
M3	46	29	80	25	6	30	18	97	15	5	63	83	97

48

datarandom_13x3_48

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	19	79	20	5	69	86	6	22	76	29	38	87	81
M2	94	88	9	99	68	17	99	31	92	43	91	31	19
M3	61	53	46	93	50	50	43	93	11	84	77	45	28

49

datarandom_13x3_49

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	84	81	76	28	67	40	67	34	37	72	83	56	81
M2	96	94	50	65	59	35	48	80	94	51	74	15	90
M3	92	9	8	85	49	45	44	16	3	91	30	11	47

50

datarandom_13x3_50

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	80	36	3	29	92	34	27	57	53	36	63	54	17
M2	61	26	56	23	31	92	30	87	52	74	9	17	81
M3	39	9	59	32	38	34	18	23	74	73	18	76	86

98

datarandom_13x3_98

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	2	60	93	2	2	70	13	12	59	97	64	16	93
M2	45	86	46	36	44	55	99	99	4	29	85	61	66
M3	99	34	97	45	76	34	88	49	67	30	32	52	95

99

datarandom_13x3_99

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	97	51	5	60	61	25	39	34	35	82	94	44	86
M2	68	22	97	95	72	81	82	4	31	55	82	18	68
M3	59	83	15	23	87	30	71	18	75	94	14	86	70

100

datarandom_13x3_100

	J1	J2	J3	J4	J5	J6	J7	J8	J9	J10	J11	J12	J13
M1	96	50	64	46	25	74	14	19	40	17	51	31	92
M2	74	69	35	81	39	15	76	81	52	36	88	43	96
M3	42	97	3	59	46	95	76	62	37	35	48	70	60

Lampiran 3. Hasil *Makespan* Permasalahan Penjadwalan Kombinasi 8 *Job* 3 *Machine* (*Small Size*) sebanyak 100 *Run*

1. Hasil *Makespan* Algoritma *Pour*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	3-1-5-7-8-4-6-2	489	0.286
2	6-8-3-7-2-1-4-5	562	0.143
3	3-6-7-4-2-5-8-1	494	0.139
4	5-2-1-4-7-6-8-3	526	0.137
5	1-2-4-6-3-5-8-7	519	0.140
6	1-2-3-4-5-6-7-8	501	0.157
7	6-1-2-4-5-3-7-8	653	0.134
8	1-2-3-4-5-6-7-8	514	0.142
9	3-2-1-6-7-4-8-5	545	0.147
10	1-2-4-6-5-7-3-8	615	0.137
11	6-4-1-8-2-7-5-3	566	0.140
12	2-4-1-5-6-7-8-3	597	0.136
13	1-8-3-7-5-4-6-2	468	0.140
14	2-5-3-1-4-6-7-8	582	0.135
15	5-4-8-2-1-6-7-3	590	0.137
16	5-4-3-7-2-8-1-6	615	0.144
17	1-3-2-4-5-6-8-7	621	0.136
18	7-4-8-6-1-2-3-5	522	0.141
19	1-2-3-6-4-7-8-5	581	0.164
20	6-1-4-7-2-3-5-8	533	0.139
21	5-1-2-7-8-4-3-6	403	0.153
22	7-6-2-1-3-4-5-8	553	0.137
23	6-8-1-3-5-2-4-7	529	0.143
24	8-1-3-5-7-2-4-6	655	0.140
25	1-5-6-4-3-7-8-2	605	0.152
26	3-4-1-5-2-6-7-8	580	0.147
27	2-6-8-1-4-5-7-3	538	0.150
28	1-2-3-5-4-6-8-7	651	0.139
29	4-5-6-7-8-1-2-3	517	0.145
30	1-4-8-2-3-5-7-6	570	0.140
31	2-3-1-4-5-6-7-8	581	0.152
32	5-7-4-2-1-3-6-8	561	0.136
33	1-2-3-5-6-8-7-4	577	0.142
34	6-1-2-4-5-3-8-7	465	0.138
35	7-2-3-6-8-1-4-5	420	0.137
36	5-4-3-2-6-1-7-8	510	0.135
37	7-8-6-5-3-2-4-1	541	0.134
38	7-6-4-2-5-1-8-3	664	0.152
39	7-1-2-4-5-6-8-3	518	0.135
40	6-2-1-3-8-4-5-7	447	0.137
41	8-4-3-5-2-7-6-1	524	0.150

42	1-2-6-8-5-3-7-4	637	0.136
43	1-5-7-2-3-6-8-4	560	0.151
44	3-5-4-1-2-7-8-6	498	0.134
45	7-3-2-1-6-8-5-4	597	0.137
46	7-5-2-3-1-4-6-8	572	0.137
47	2-1-5-3-4-7-6-8	526	0.149
48	5-1-4-2-3-8-7-6	638	0.163
49	4-1-2-3-6-5-8-7	531	0.142
50	2-5-1-8-6-3-4-7	552	0.141
51	5-2-3-4-7-1-6-8	488	0.148
52	8-6-3-2-7-5-4-1	536	0.136
53	7-5-4-2-1-6-3-8	574	0.137
54	3-7-8-1-5-4-6-2	470	0.155
55	3-7-4-1-2-6-8-5	521	0.134
56	1-4-8-5-3-7-2-6	534	0.139
57	7-4-2-1-3-8-5-6	462	0.149
58	1-4-8-6-2-7-5-3	672	0.156
59	8-2-7-4-5-3-6-1	482	0.140
60	5-1-2-4-6-7-8-3	550	0.135
61	4-2-3-5-1-7-8-6	626	0.150
62	3-2-1-4-6-5-7-8	571	0.137
63	5-3-2-6-7-8-4-1	545	0.141
64	1-2-4-5-6-7-8-3	718	0.138
65	1-6-4-2-3-8-7-5	633	0.147
66	1-2-3-5-7-4-8-6	603	0.134
67	8-1-3-4-5-2-6-7	476	0.158
68	7-1-2-8-3-6-4-5	540	0.137
69	7-2-1-3-8-6-4-5	550	0.142
70	5-4-2-1-6-7-3-8	616	0.153
71	8-5-4-2-3-6-1-7	533	0.156
72	1-2-3-6-4-8-7-5	492	0.136
73	7-4-8-5-2-3-1-6	472	0.140
74	4-1-3-5-6-2-8-7	646	0.142
75	8-3-1-4-2-6-7-5	620	0.140
76	7-6-4-8-2-3-1-5	600	0.149
77	2-3-7-6-1-5-4-8	510	0.134
78	6-2-8-5-7-3-4-1	614	0.140
79	7-8-3-5-1-6-4-2	596	0.144
80	1-3-4-5-2-6-7-8	558	0.141
81	8-2-1-4-5-6-3-7	592	0.156
82	6-3-1-2-7-8-4-5	628	0.139
83	5-4-2-3-8-6-7-1	560	0.137
84	7-2-3-1-5-6-8-4	716	0.136
85	7-3-8-1-2-4-6-5	538	0.141
86	2-1-4-7-8-5-6-3	516	0.142
87	1-4-8-2-6-3-5-7	544	0.134
88	2-4-6-7-3-5-8-1	624	0.138
89	4-8-6-7-1-2-3-5	430	0.142

90	4-2-1-5-6-3-8-7	580	0.137
91	1-3-2-7-8-4-6-5	481	0.156
92	3-1-4-5-2-7-6-8	592	0.137
93	1-2-3-4-5-6-8-7	508	0.155
94	5-8-4-3-1-6-2-7	613	0.138
95	8-3-1-2-4-5-7-6	586	0.150
96	1-2-3-7-5-4-6-8	494	0.133
97	7-4-2-6-8-1-5-3	587	0.138
98	5-7-6-1-3-8-4-2	537	0.150
99	4-2-3-7-1-6-8-5	585	0.140
100	1-2-4-3-5-6-8-7	635	0.155
Terendah		403	0.133
Tertinggi		718	0.286
Total		55767	14.398
Rata-Rata		557.67	0.144

2. Hasil *Makespan* Algoritma NST

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	3-1-4-2-6-7-8-5	535	0.217
2	1-2-3-4-5-8-6-7	643	0.127
3	3-2-4-5-1-6-7-8	510	0.122
4	1-2-3-4-5-6-7-8	555	0.100
5	1-2-3-4-5-6-7-8	522	0.098
6	1-2-3-4-5-6-7-8	501	0.104
7	1-2-3-5-7-6-4-8	571	0.116
8	1-2-3-4-5-6-7-8	514	0.103
9	1-2-4-3-6-5-8-7	560	0.111
10	1-2-3-5-4-6-7-8	579	0.105
11	1-2-4-3-5-6-8-7	446	0.110
12	1-2-4-6-3-5-8-7	596	0.112
13	1-3-2-6-4-5-7-8	470	0.113
14	1-2-3-5-4-6-7-8	521	0.110
15	2-1-4-3-5-6-7-8	608	0.107
16	1-2-3-4-5-6-7-8	711	0.105
17	4-3-1-2-5-6-8-7	580	0.124
18	1-2-3-4-6-5-7-8	553	0.112
19	1-2-3-4-5-6-7-8	644	0.105
20	1-2-4-3-5-6-7-8	544	0.116
21	1-2-4-3-5-6-7-8	385	0.125
22	1-2-3-4-6-5-7-8	595	0.108
23	2-1-3-4-5-6-7-8	494	0.107
24	1-2-3-4-5-6-8-7	729	0.103
25	1-2-3-4-5-6-7-8	605	0.102
26	1-3-2-4-5-7-6-8	540	0.104
27	2-1-4-5-6-3-7-8	559	0.113
28	1-2-3-5-4-6-8-7	651	0.105
29	1-3-2-4-8-5-7-6	461	0.118
30	2-1-3-4-5-7-8-6	492	0.110
31	2-1-4-3-5-7-8-6	553	0.116
32	1-4-2-5-3-6-8-7	547	0.131
33	1-2-3-4-5-6-8-7	637	0.126
34	1-2-5-3-4-6-8-7	475	0.119
35	2-1-4-3-5-7-6-8	466	0.109
36	1-2-5-3-4-6-7-8	593	0.105
37	2-3-1-5-6-4-7-8	585	0.114
38	4-1-2-6-3-5-7-8	652	0.116
39	1-3-2-4-5-8-6-7	567	0.115
40	1-2-3-6-4-5-7-8	452	0.150
41	4-1-2-3-5-6-7-8	669	0.116
42	1-2-3-4-5-6-7-8	637	0.099
43	1-2-3-5-7-4-8-6	555	0.122
44	3-2-1-4-5-6-8-7	500	0.131

45	2-1-3-4-5-6-7-8	635	0.103
46	2-3-1-5-4-6-7-8	587	0.109
47	2-1-3-4-5-7-6-8	526	0.105
48	2-7-1-5-4-3-8-6	609	0.131
49	1-2-3-4-6-5-7-8	501	0.104
50	2-1-3-4-5-6-8-7	552	0.108
51	2-1-3-4-5-6-7-8	509	0.101
52	1-2-3-4-6-8-5-7	595	0.109
53	2-1-4-5-3-6-7-8	613	0.111
54	1-3-2-4-7-8-5-6	503	0.116
55	1-2-3-4-5-6-7-8	517	0.099
56	1-3-2-4-5-6-8-7	507	0.106
57	2-3-4-1-5-6-7-8	495	0.110
58	1-2-3-4-5-6-7-8	672	0.110
59	1-2-3-8-4-5-6-7	483	0.123
60	1-2-3-4-5-6-8-7	553	0.102
61	1-2-5-3-4-8-6-7	598	0.127
62	1-2-3-4-5-6-7-8	489	0.102
63	1-2-5-3-4-6-8-7	590	0.110
64	1-2-3-4-8-5-6-7	705	0.108
65	1-2-3-4-5-8-6-7	618	0.112
66	1-2-3-4-5-6-7-8	626	0.104
67	1-2-3-4-5-8-6-7	525	0.110
68	1-2-3-4-5-7-8-6	549	0.111
69	1-2-3-4-5-6-7-8	652	0.103
70	2-4-3-1-5-6-7-8	604	0.113
71	3-4-5-1-2-6-8-7	518	0.127
72	1-3-2-4-6-5-8-7	490	0.107
73	3-2-4-5-1-6-8-7	475	0.119
74	2-1-3-5-4-6-7-8	688	0.105
75	1-2-3-4-5-6-7-8	694	0.114
76	4-1-6-2-5-3-8-7	649	0.128
77	2-3-4-1-5-7-6-8	526	0.116
78	2-1-3-4-5-6-7-8	651	0.106
79	1-5-7-6-2-3-8-4	558	0.137
80	1-2-3-4-6-7-5-8	552	0.109
81	1-2-3-4-5-6-8-7	621	0.106
82	3-1-6-4-2-8-5-7	615	0.128
83	1-2-3-4-5-6-7-8	600	0.103
84	1-3-2-4-5-6-8-7	705	0.105
85	1-2-4-3-5-6-7-8	514	0.105
86	2-1-3-4-5-6-8-7	553	0.111
87	1-4-3-5-2-6-7-8	544	0.115
88	1-2-3-4-5-8-7-6	651	0.115
89	3-6-1-4-2-5-8-7	402	0.128
90	1-3-2-4-5-6-7-8	624	0.106
91	1-2-3-4-5-6-7-8	481	0.102
92	3-1-4-2-5-6-7-8	592	0.114

93	1-3-2-4-5-6-8-7	497	0.112
94	1-2-3-5-4-6-7-8	692	0.102
95	1-2-3-5-4-8-6-7	664	0.111
96	1-3-2-5-4-6-7-8	478	0.107
97	1-2-4-3-8-7-6-5	598	0.123
98	3-1-5-2-6-8-4-7	555	0.143
99	1-2-3-4-6-7-5-8	607	0.106
100	1-3-2-4-5-6-8-7	635	0.106
Terendah		385	0.098
Tertinggi		729	0.217
Total		56804	11.344
Rata-Rata		568.04	0.113

3. Hasil *Makespan* Algoritma *Tabu Search*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	3-1-4-2-6-7-8-5	535	4.766
2	1-2-3-4-5-8-6-7	643	5.011
3	3-5-4-2-1-6-7-8	494	5.143
4	5-1-4-2-3-7-6-8	518	4.725
5	2-4-1-3-8-5-6-7	516	4.778
6	1-2-3-4-5-6-7-8	501	4.667
7	1-2-3-5-7-6-4-8	571	4.863
8	1-2-3-4-5-6-7-8	514	4.858
9	6-8-1-2-4-3-7-5	462	5.030
10	1-2-3-5-4-6-7-8	579	4.729
11	1-2-4-3-5-6-8-7	446	4.688
12	1-2-4-6-3-5-8-7	596	4.842
13	6-1-3-2-4-5-8-7	448	4.757
14	1-3-2-5-7-6-4-8	517	5.135
15	6-2-1-5-4-8-7-3	566	4.858
16	2-4-3-5-1-6-8-7	674	4.866
17	4-3-1-2-5-6-8-7	580	4.845
18	1-2-3-4-6-5-7-8	553	4.879
19	5-6-4-3-7-1-2-8	583	4.823
20	1-2-6-4-3-5-7-8	526	4.776
21	1-2-4-3-5-6-7-8	385	4.734
22	7-6-1-2-3-5-4-8	549	5.029
23	2-1-3-4-5-6-7-8	494	4.821
24	2-5-4-1-8-7-3-6	661	4.959
25	5-1-3-2-6-4-7-8	602	4.718
26	6-3-4-7-1-8-5-2	526	4.725
27	2-6-1-4-5-7-3-8	526	4.829
28	1-2-3-5-4-6-8-7	651	4.775
29	1-3-2-4-8-5-7-6	461	5.018
30	2-7-5-1-4-6-3-8	491	5.059
31	2-4-1-5-7-8-3-6	541	4.633
32	6-4-5-2-1-3-7-8	523	4.696
33	1-2-3-4-5-6-8-7	637	4.753
34	1-2-5-3-4-6-8-7	475	5.004
35	7-2-1-4-5-6-3-8	420	4.712
36	6-2-5-1-4-3-7-8	498	4.798
37	5-3-2-6-4-1-7-8	543	5.120
38	4-1-2-6-3-5-7-8	652	4.827
39	8-1-4-5-3-2-6-7	519	4.830
40	6-1-2-4-3-5-7-8	442	5.011
41	4-1-3-8-6-7-2-5	627	4.823
42	1-2-3-4-5-6-7-8	637	4.664
43	1-2-3-5-7-4-8-6	555	4.870
44	3-2-4-5-8-7-6-1	478	5.196

45	8-6-7-3-1-2-4-5	554	5.009
46	2-3-1-5-4-6-7-8	587	4.793
47	2-1-3-4-5-7-6-8	526	4.803
48	2-7-1-5-4-3-8-6	609	5.011
49	3-2-1-6-4-5-8-7	479	4.903
50	2-1-3-4-5-6-8-7	552	4.680
51	5-2-4-1-3-6-7-8	488	4.772
52	3-2-8-6-4-1-5-7	508	4.808
53	7-4-2-5-3-1-6-8	574	4.771
54	1-3-2-4-7-8-5-6	503	4.652
55	2-3-6-1-4-7-8-5	475	5.180
56	1-3-2-4-5-6-8-7	507	4.690
57	7-2-3-4-6-1-8-5	449	4.822
58	1-2-3-4-5-6-7-8	672	4.680
59	1-2-3-8-4-5-6-7	483	4.746
60	1-2-3-4-5-6-8-7	553	4.593
61	1-2-5-3-4-8-6-7	598	4.660
62	1-6-2-7-5-3-4-8	465	4.841
63	2-5-1-3-6-4-8-7	565	4.782
64	1-2-3-4-8-5-6-7	705	4.715
65	1-2-3-4-5-8-6-7	618	4.765
66	2-5-1-7-3-4-8-6	582	4.694
67	5-1-8-3-7-2-4-6	462	4.794
68	1-2-3-4-5-7-8-6	549	4.734
69	1-2-3-4-5-6-7-8	652	4.924
70	2-5-4-3-1-6-7-8	593	4.799
71	5-3-4-1-2-6-8-7	513	5.238
72	3-1-7-8-6-4-2-5	454	5.137
73	3-8-4-7-5-1-2-6	396	4.970
74	3-5-8-4-6-2-1-7	572	5.337
75	1-2-3-4-5-6-7-8	694	4.770
76	5-2-6-4-1-8-7-3	626	4.802
77	2-5-1-7-3-6-4-8	510	4.714
78	2-3-4-7-1-8-5-6	615	4.831
79	7-1-5-6-2-3-8-4	546	4.750
80	4-1-3-6-7-5-2-8	527	4.694
81	1-2-3-4-5-6-8-7	621	4.892
82	6-3-4-1-8-5-7-2	579	4.944
83	1-2-3-4-5-6-7-8	600	4.692
84	1-3-2-4-5-6-8-7	705	4.803
85	4-3-5-1-6-7-2-8	474	4.810
86	8-5-2-3-1-6-4-7	452	4.905
87	6-1-4-3-5-2-7-8	517	4.772
88	1-2-3-4-5-8-7-6	651	4.817
89	6-3-4-1-8-2-5-7	400	4.693
90	6-8-1-3-2-4-5-7	565	4.766
91	4-3-2-1-5-6-7-8	474	4.817
92	3-1-4-2-5-6-7-8	592	4.701

93	5-1-3-2-6-4-8-7	484	4.844
94	5-8-6-1-2-3-4-7	589	4.941
95	2-8-5-1-3-4-7-6	586	4.907
96	1-4-5-3-8-7-6-2	437	5.693
97	1-2-4-3-8-7-6-5	598	4.699
98	3-1-8-6-5-4-7-2	551	5.153
99	4-1-2-6-3-8-5-7	559	5.040
100	1-3-2-4-5-6-8-7	635	4.688
Terendah		385	4.593
Tertinggi		705	5.693
Total		54545	485.079
Rata-Rata		545.45	4.851

Lampiran 4. Hasil *Makespan* Permasalahan Penjadwalan Kombinasi 13 *Job* 3 *Machine* (*Medium Size*) sebanyak 100 *Run*

1. Hasil *Makespan* Algoritma *Pour*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	2-3-4-10-5-6-9-11-13-7-8-12-1	848	0.656
2	3-2-5-7-10-4-9-6-8-11-12-1-13	867	0.234
3	6-9-2-3-5-10-12-4-8-11-7-13-1	867	0.231
4	1-2-3-4-5-7-8-9-10-11-12-13-6	918	0.220
5	6-1-8-5-3-4-10-7-12-9-13-2-11	761	0.216
6	12-1-2-3-6-4-5-7-9-8-11-10-13	950	0.212
7	9-1-8-10-6-3-4-5-7-11-12-2-13	798	0.213
8	5-10-11-7-1-6-2-4-13-12-9-8-3	851	0.220
9	11-8-3-7-13-9-2-6-4-12-5-10-1	783	0.221
10	11-10-13-5-1-6-9-2-8-3-7-4-12	863	0.221
11	9-7-1-6-2-10-4-3-5-8-12-11-13	790	0.218
12	13-8-1-2-3-5-7-12-9-10-6-11-4	803	0.221
13	6-2-7-8-5-9-1-10-11-3-12-4-13	766	0.222
14	4-2-7-1-5-3-6-13-8-12-10-11-9	800	0.215
15	2-3-5-13-6-10-7-9-11-4-12-8-1	815	0.235
16	1-5-3-2-4-13-12-6-9-11-10-8-7	753	0.224
17	4-3-1-10-12-5-7-8-13-9-2-11-6	907	0.257
18	8-1-11-3-6-5-2-9-10-12-4-13-7	730	0.214
19	4-11-9-6-10-2-13-3-5-1-12-8-7	981	0.217
20	4-9-5-13-6-10-1-2-3-8-7-12-11	686	0.214
21	7-2-8-1-3-13-5-9-6-4-12-11-10	929	0.240
22	11-8-4-2-12-10-5-6-7-1-9-13-3	721	0.234
23	3-5-8-1-2-4-6-9-10-11-13-12-7	913	0.214
24	12-1-3-4-5-6-7-10-8-2-11-13-9	739	0.215
25	2-12-1-4-7-10-3-5-11-6-9-13-8	692	0.269
26	1-6-3-10-5-11-7-2-12-8-9-13-4	731	0.212
27	1-2-3-4-12-5-6-11-13-7-8-9-10	844	0.216
28	3-1-2-4-11-5-6-7-9-10-12-13-8	658	0.229
29	3-1-2-4-12-9-5-8-11-7-10-6-13	853	0.237
30	3-2-5-6-4-9-10-1-11-13-7-12-8	925	0.216
31	3-5-11-1-12-7-9-6-13-10-8-4-2	934	0.233
32	10-4-6-1-7-8-9-11-2-12-3-13-5	753	0.221
33	11-4-1-10-7-3-2-5-8-12-13-6-9	770	0.219
34	11-7-9-12-3-10-2-4-6-8-13-5-1	878	0.248
35	7-1-13-12-11-8-3-2-9-4-5-6-10	868	0.217
36	3-12-1-5-6-9-10-11-8-13-4-2-7	891	0.217
37	5-1-2-11-4-9-6-3-12-10-7-13-8	812	0.219
38	6-4-2-10-9-5-13-1-8-7-11-12-3	1003	0.223
39	7-6-4-11-12-3-2-1-10-5-8-13-9	794	0.218
40	13-1-5-6-2-9-10-8-11-4-12-3-7	890	0.215
41	13-5-2-1-10-3-4-6-11-7-9-12-8	880	0.233

42	3-9-6-4-5-2-12-1-7-8-10-13-11	873	0.225
43	1-9-10-2-3-4-8-12-5-6-11-13-7	747	0.244
44	2-5-6-4-3-7-10-11-13-1-8-12-9	829	0.215
45	2-12-4-3-13-1-10-7-5-6-11-9-8	761	0.216
46	1-2-3-4-5-6-8-9-10-11-12-7-13	743	0.241
47	3-10-1-6-4-8-9-5-11-12-7-13-2	686	0.230
48	4-1-7-11-2-8-9-10-13-3-5-12-6	945	0.243
49	1-4-13-3-8-5-6-7-11-9-10-2-12	946	0.221
50	13-3-6-2-7-8-4-9-10-1-11-12-5	782	0.223
51	10-12-2-4-5-3-1-6-8-9-11-13-7	793	0.232
52	1-8-6-2-3-4-5-12-9-7-10-11-13	766	0.224
53	1-2-5-6-3-7-8-9-10-11-12-4-13	808	0.220
54	4-1-6-8-9-12-2-13-10-5-11-3-7	871	0.222
55	1-2-3-4-9-10-11-12-13-8-5-7-6	917	0.225
56	11-4-1-2-5-6-3-7-10-13-8-9-12	792	0.219
57	13-2-9-10-3-4-6-1-7-12-5-11-8	900	0.215
58	9-7-4-1-10-2-5-8-6-11-13-12-3	782	0.269
59	1-2-4-7-9-5-13-8-3-10-11-6-12	829	0.220
60	11-1-2-3-4-5-6-7-8-13-12-10-9	824	0.221
61	10-1-7-4-13-2-3-5-6-9-12-11-8	842	0.247
62	3-2-4-1-5-7-6-9-8-10-13-11-12	704	0.221
63	11-4-7-8-1-2-3-5-6-9-13-10-12	935	0.225
64	5-7-10-2-4-3-6-8-1-11-9-13-12	838	0.221
65	11-4-8-7-1-3-5-6-2-9-12-10-13	842	0.239
66	12-8-10-1-3-4-2-6-5-11-9-7-13	727	0.221
67	2-5-9-1-3-4-6-7-8-10-11-12-13	958	0.222
68	1-2-6-10-12-3-4-5-8-7-13-9-11	752	0.262
69	2-3-5-4-1-6-7-8-9-13-10-12-11	868	0.220
70	2-3-1-4-6-7-8-9-10-11-12-5-13	815	0.216
71	4-5-9-11-2-1-10-3-13-6-7-12-8	867	0.238
72	6-12-2-1-4-11-13-7-5-10-8-9-3	758	0.248
73	2-10-5-1-3-4-6-13-7-8-11-12-9	857	0.220
74	1-9-7-2-5-6-4-11-12-13-3-8-10	736	0.219
75	8-5-1-3-10-11-2-6-12-7-9-13-4	871	0.212
76	1-2-9-3-4-5-13-11-10-12-8-6-7	751	0.273
77	10-6-4-1-12-3-7-2-11-5-9-8-13	819	0.221
78	4-5-6-1-2-7-9-8-11-10-12-13-3	692	0.230
79	5-6-7-8-1-4-9-3-11-10-12-2-13	829	0.213
80	11-12-5-1-7-2-3-4-6-8-10-9-13	750	0.221
81	8-3-13-9-10-7-4-1-6-11-2-5-12	902	0.228
82	11-13-6-9-7-8-1-10-12-5-2-3-4	983	0.227
83	1-3-2-4-9-13-6-7-8-10-5-12-11	833	0.221
84	12-2-1-3-4-5-6-7-8-11-13-9-10	806	0.216
85	11-1-2-4-3-6-8-5-10-9-13-12-7	929	0.262
86	4-1-11-2-3-8-5-6-7-10-9-13-12	889	0.222
87	2-9-6-3-7-8-11-4-5-10-12-13-1	805	0.227
88	10-5-2-1-3-7-6-8-9-4-12-11-13	853	0.222
89	11-8-7-5-2-1-4-6-3-12-13-10-9	779	0.221

90	4-10-3-1-11-2-5-8-6-9-7-13-12	880	0.224
91	8-6-10-5-2-1-3-7-11-12-9-13-4	729	0.238
92	7-8-2-3-5-1-9-6-10-11-12-4-13	830	0.221
93	2-1-6-10-4-11-3-9-13-5-7-12-8	951	0.222
94	11-6-2-3-9-1-13-4-7-8-5-10-12	792	0.223
95	8-11-9-12-2-1-5-6-4-10-7-3-13	827	0.223
96	12-2-10-5-13-11-3-6-7-4-8-1-9	934	0.218
97	8-1-6-12-5-11-2-3-7-9-13-10-4	885	0.215
98	7-1-8-2-4-13-3-12-11-5-6-9-10	927	0.250
99	3-5-2-12-4-13-6-1-7-8-9-10-11	887	0.221
100	7-8-2-4-3-5-6-10-9-11-13-12-1	854	0.222
Terendah		658	0.212
Tertinggi		1003	0.656
Total		83095	23.061
Rata-Rata		830.95	0.231

2. Hasil *Makespan* Algoritma NST

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	1-2-4-3-6-5-8-9-7-11-13-12-10	877	0.372
2	1-3-2-5-4-7-6-8-11-9-10-12-13	902	0.156
3	3-4-2-1-5-7-9-6-11-10-12-13-8	837	0.221
4	1-2-3-4-5-6-7-8-9-10-11-12-13	928	0.104
5	1-2-3-4-6-7-8-5-9-10-11-12-13	801	0.133
6	1-2-3-4-5-6-7-8-9-10-11-12-13	984	0.107
7	1-2-3-4-5-6-8-7-10-11-9-12-13	924	0.133
8	4-2-3-1-5-6-7-8-9-10-11-12-13	861	0.151
9	1-3-5-2-4-7-9-6-8-11-10-12-13	895	0.170
10	1-2-3-4-5-6-7-8-9-10-11-12-13	847	0.107
11	1-3-2-4-5-7-6-8-9-10-12-11-13	758	0.134
12	2-3-1-5-8-4-7-6-10-9-11-12-13	838	0.179
13	1-2-6-3-8-4-5-9-10-7-12-11-13	742	0.186
14	2-1-3-4-5-6-7-8-9-10-11-13-12	784	0.120
15	1-2-3-4-5-7-6-9-11-8-12-10-13	878	0.154
16	2-1-3-4-5-6-7-8-10-11-9-12-13	748	0.131
17	3-1-2-4-5-6-8-7-10-9-11-12-13	848	0.143
18	1-2-3-5-4-6-8-7-9-10-12-11-13	784	0.132
19	1-4-3-2-5-6-8-7-9-10-11-13-12	1043	0.158
20	4-3-1-5-2-6-7-9-8-10-11-12-13	668	0.165
21	1-2-3-4-5-7-6-8-9-10-11-12-13	938	0.113
22	2-1-4-5-3-6-7-9-8-10-11-12-13	754	0.157
23	1-2-3-4-5-6-7-8-9-10-11-12-13	952	0.109
24	1-3-2-5-6-4-7-9-8-12-13-10-11	765	0.175
25	1-2-3-4-5-7-6-10-9-11-8-12-13	748	0.151
26	1-2-3-4-6-5-7-8-10-9-11-12-13	806	0.122
27	2-1-3-4-5-6-7-8-12-9-10-11-13	831	0.138
28	2-4-3-1-5-6-7-8-9-10-12-13-11	653	0.161
29	1-4-2-3-5-6-7-8-9-10-11-12-13	843	0.123
30	1-2-3-4-5-6-7-8-9-10-11-12-13	918	0.103
31	1-2-3-4-5-6-7-8-9-10-11-12-13	1028	0.106
32	1-2-3-4-6-7-8-5-9-10-12-11-13	852	0.140
33	2-4-1-3-5-6-7-8-9-10-11-12-13	756	0.132
34	2-1-3-4-5-7-6-8-10-11-9-12-13	886	0.142
35	1-3-2-5-4-6-7-8-9-10-11-13-12	875	0.135
36	1-2-3-4-5-6-8-7-10-11-9-13-12	967	0.141
37	2-5-1-4-3-6-7-8-9-10-11-12-13	768	0.148
38	2-1-3-4-5-6-7-8-9-10-11-12-13	1041	0.116
39	2-3-4-5-1-6-7-8-9-10-11-13-12	813	0.151
40	1-2-4-5-3-6-7-9-10-8-11-13-12	927	0.152
41	1-2-3-4-5-7-6-10-8-13-9-12-11	923	0.169
42	3-2-1-4-5-6-7-8-9-10-11-12-13	873	0.133
43	1-2-3-4-5-6-7-8-10-9-12-11-13	712	0.129
44	1-2-3-4-5-6-7-8-9-13-12-10-11	757	0.151
45	1-2-3-4-5-6-7-8-9-10-11-13-12	713	0.112

46	2-1-3-4-5-6-8-12-7-9-11-10-13	732	0.168
47	1-3-2-4-5-6-9-7-8-10-11-12-13	683	0.135
48	1-2-3-4-5-6-7-8-10-9-12-13-11	883	0.133
49	2-1-3-4-5-6-7-8-9-10-13-11-12	958	0.137
50	1-2-3-4-5-6-7-8-9-10-11-12-13	865	0.111
51	1-2-4-5-3-6-8-7-9-10-11-12-13	903	0.132
52	2-3-4-1-6-7-9-5-10-8-12-13-11	690	0.196
53	1-2-3-4-5-6-7-8-9-10-11-12-13	857	0.107
54	1-2-4-5-3-6-10-12-9-7-8-13-11	828	0.211
55	1-2-3-4-5-6-7-8-9-10-13-11-12	864	0.147
56	1-2-3-4-5-6-7-8-9-10-11-13-12	833	0.113
57	2-1-3-4-6-5-7-8-9-10-11-13-12	873	0.136
58	1-2-3-4-5-6-7-8-9-10-11-12-13	935	0.140
59	1-2-3-4-5-6-7-8-9-10-11-12-13	889	0.108
60	1-2-3-4-5-7-6-10-8-11-9-12-13	844	0.147
61	1-2-3-4-5-6-7-9-8-10-11-12-13	813	0.119
62	3-1-2-4-5-6-7-8-9-10-13-11-12	704	0.143
63	1-2-3-4-5-6-7-8-9-10-11-13-12	946	0.118
64	2-1-3-4-5-6-7-8-9-10-11-12-13	909	0.119
65	1-2-3-4-6-7-8-5-9-10-12-11-13	886	0.142
66	1-2-3-4-5-6-7-10-8-12-13-9-11	744	0.159
67	2-1-3-4-5-6-7-9-8-10-12-11-13	954	0.134
68	1-2-3-4-5-6-7-8-9-10-11-12-13	729	0.108
69	1-2-3-4-5-6-7-8-9-10-11-12-13	928	0.108
70	1-2-3-4-5-6-7-11-8-9-12-10-13	786	0.152
71	2-1-4-3-5-6-7-9-8-12-11-10-13	955	0.162
72	1-2-4-6-3-5-7-8-9-10-11-12-13	739	0.133
73	2-3-4-1-5-6-8-7-10-9-12-11-13	857	0.157
74	1-2-4-3-5-7-6-8-9-10-11-13-12	801	0.133
75	1-2-3-5-4-6-7-8-9-10-11-12-13	942	0.118
76	1-2-3-4-5-6-9-7-8-11-13-12-10	731	0.162
77	2-1-3-4-5-6-7-8-10-9-12-11-13	766	0.136
78	1-2-5-4-6-7-3-9-8-10-11-12-13	706	0.161
79	1-3-2-4-6-5-7-8-9-10-12-11-13	848	0.133
80	1-2-3-4-5-6-7-8-10-11-12-9-13	773	0.137
81	3-1-2-4-5-8-7-6-9-10-11-12-13	977	0.151
82	1-4-5-2-6-3-7-8-9-10-13-11-12	953	0.169
83	1-2-3-4-5-6-7-8-10-9-11-12-13	834	0.116
84	1-2-3-4-5-6-7-8-9-12-10-13-11	746	0.138
85	1-3-2-4-5-6-7-8-9-10-13-12-11	868	0.144
86	1-2-3-4-5-6-7-8-9-10-11-12-13	887	0.111
87	1-2-3-4-5-6-7-9-8-10-11-13-12	858	0.123
88	1-2-5-3-7-4-8-9-6-12-10-11-13	853	0.178
89	2-1-3-4-5-6-7-8-9-10-11-12-13	806	0.117
90	2-1-3-4-5-6-7-8-9-10-11-12-13	867	0.115
91	2-1-4-3-6-5-8-7-9-10-11-13-12	759	0.152
92	2-1-3-4-5-6-7-9-8-10-12-13-11	837	0.144
93	2-1-3-4-5-6-7-8-9-10-11-12-13	921	0.114

94	4-1-3-2-6-5-7-8-9-11-10-13-12	769	0.170
95	2-1-5-6-3-7-4-8-9-10-11-12-13	933	0.159
96	2-5-3-7-4-1-6-8-10-9-11-12-13	952	0.195
97	2-1-3-5-4-6-7-8-9-10-12-11-13	956	0.133
98	4-1-2-3-5-6-7-9-8-10-13-11-12	836	0.162
99	1-2-3-5-7-8-9-4-10-6-12-13-11	924	0.196
100	2-4-1-3-5-6-7-8-9-10-11-12-13	902	0.138
Terendah		653	0.103
Tertinggi		1043	0.372
Total		84638	14.337
Rata-Rata		846.38	0.143

3. Hasil *Makespan* Algoritma *Tabu Search*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	1-2-4-3-6-5-8-9-7-11-13-12-10	877	10.535
2	2-5-3-7-1-4-6-8-11-9-10-12-13	897	10.338
3	3-4-2-1-5-7-9-6-11-10-12-13-8	837	10.357
4	1-2-3-4-5-6-7-8-9-10-11-12-13	928	10.479
5	1-4-2-3-6-7-8-10-5-9-11-12-13	740	10.486
6	3-1-2-5-7-6-4-9-8-10-11-12-13	950	10.484
7	3-1-2-11-12-4-6-10-7-8-9-5-13	846	10.441
8	5-4-3-2-1-6-7-8-9-10-11-12-13	846	10.339
9	3-2-5-7-9-1-8-4-11-6-12-13-10	821	10.685
10	10-1-5-4-2-3-7-6-9-8-11-12-13	832	10.482
11	5-1-3-7-2-6-4-9-10-8-12-13-11	722	10.361
12	10-3-2-7-8-5-1-6-4-11-12-13-9	757	10.531
13	10-1-8-2-4-12-6-3-5-9-11-13-7	692	10.451
14	2-10-5-1-3-6-7-13-4-9-8-11-12	724	10.730
15	1-2-3-4-5-7-6-9-11-8-12-10-13	878	10.546
16	2-1-3-4-5-6-7-8-10-11-9-12-13	748	10.444
17	3-1-2-4-5-6-8-7-10-9-11-12-13	848	10.546
18	1-2-3-5-4-6-8-7-9-10-12-11-13	784	10.356
19	4-5-6-3-2-8-9-10-1-11-7-13-12	978	10.321
20	5-4-3-1-2-6-7-9-8-10-11-12-13	662	10.497
21	1-2-3-4-5-7-6-8-9-10-11-12-13	938	10.453
22	2-4-5-3-6-1-7-9-8-10-11-12-13	744	10.452
23	4-6-1-2-3-5-8-7-10-9-11-12-13	907	10.570
24	1-3-2-5-6-4-7-9-8-12-13-10-11	765	10.777
25	10-2-7-4-1-5-3-11-6-9-12-13-8	682	10.529
26	1-6-4-5-8-3-10-2-7-11-9-12-13	731	10.764
27	2-1-3-4-5-6-7-8-12-9-10-11-13	831	10.354
28	2-4-3-1-5-6-7-8-9-10-12-13-11	653	10.375
29	2-8-4-3-6-7-5-1-9-10-12-11-13	806	10.610
30	6-3-1-2-5-7-8-10-11-9-4-12-13	843	10.519
31	5-3-4-1-2-6-7-8-9-10-11-12-13	997	10.498
32	3-4-2-6-7-1-8-5-9-12-10-11-13	803	10.357
33	2-4-1-3-5-6-7-8-9-10-11-12-13	756	10.546
34	7-3-4-5-1-6-2-10-8-11-9-12-13	811	10.303
35	1-3-2-5-4-6-7-8-9-10-11-13-12	875	10.462
36	1-2-3-4-5-6-8-7-10-11-9-13-12	967	10.467
37	2-5-1-4-3-6-7-8-9-10-11-12-13	768	10.459
38	2-4-5-1-3-6-7-8-9-10-11-12-13	965	10.444
39	4-2-5-6-3-7-9-1-8-10-11-13-12	768	10.361
40	2-1-5-6-4-3-7-9-10-8-11-13-12	906	10.546
41	1-2-3-4-5-7-6-10-8-13-9-12-11	923	10.623
42	3-2-1-4-5-6-7-8-9-10-11-12-13	873	11.322
43	3-1-2-4-5-6-7-8-10-12-9-11-13	697	10.492
44	1-2-3-4-5-6-7-8-9-13-12-10-11	757	10.503
45	1-9-3-5-13-4-6-2-8-10-11-12-7	639	10.725

46	2-1-3-4-5-6-8-12-7-9-11-10-13	732	10.667
47	1-3-2-4-5-6-9-7-8-10-11-12-13	683	10.364
48	1-3-4-2-5-6-7-8-10-9-12-13-11	877	10.775
49	4-8-2-1-5-3-6-7-9-10-13-11-12	905	10.434
50	3-1-2-4-6-5-7-8-9-10-11-12-13	824	10.458
51	2-1-4-5-3-6-8-7-9-11-10-12-13	898	10.630
52	2-3-4-1-6-7-9-5-10-8-12-13-11	690	10.425
53	1-2-3-4-5-6-7-8-9-10-11-12-13	857	10.394
54	1-2-4-5-3-6-10-12-9-7-8-13-11	828	10.598
55	1-2-3-4-5-6-7-8-9-10-13-11-12	864	10.432
56	1-2-3-4-5-6-7-8-9-10-11-13-12	833	10.462
57	2-4-6-1-3-7-5-8-9-10-11-13-12	860	10.478
58	1-2-3-4-5-6-7-8-9-10-11-12-13	935	10.492
59	1-2-3-4-5-6-7-8-9-10-11-12-13	889	10.635
60	1-2-3-4-5-7-6-10-8-11-9-12-13	844	10.412
61	7-1-2-3-4-6-5-9-10-8-11-12-13	791	10.645
62	3-1-2-4-5-6-7-8-9-10-13-11-12	704	10.439
63	1-2-3-4-5-6-7-8-9-10-11-13-12	946	10.293
64	3-8-4-5-1-9-2-6-7-10-11-12-13	817	10.875
65	1-2-3-4-6-7-8-5-9-10-12-11-13	886	10.518
66	10-3-4-5-6-2-1-8-7-12-13-9-11	663	10.423
67	2-1-3-4-5-6-7-9-8-10-12-11-13	954	10.554
68	1-2-3-4-5-6-7-8-9-10-11-12-13	729	10.369
69	1-2-3-4-5-6-7-8-9-10-11-12-13	928	10.623
70	1-2-3-4-5-6-7-11-8-9-12-10-13	786	10.931
71	5-4-2-1-3-6-7-9-8-12-11-10-13	923	10.501
72	1-6-9-2-3-5-7-8-11-4-12-13-10	737	10.627
73	2-3-4-1-5-6-8-7-10-9-12-11-13	857	10.464
74	1-2-4-3-5-7-6-8-9-10-11-13-12	801	10.461
75	8-7-6-2-5-1-3-4-9-11-10-12-13	846	10.546
76	1-3-2-4-5-6-9-8-7-11-13-12-10	728	10.392
77	3-4-2-1-5-6-10-8-7-9-12-11-13	725	10.493
78	1-2-5-4-6-7-3-9-8-10-11-12-13	706	10.414
79	1-12-3-2-5-6-8-4-9-7-10-13-11	772	10.510
80	10-1-8-4-3-2-11-5-6-7-12-9-13	712	10.446
81	8-4-3-1-2-7-5-9-6-10-11-12-13	922	10.354
82	6-1-4-5-2-3-7-8-9-10-13-11-12	916	10.561
83	1-2-3-4-5-6-7-10-8-12-9-11-13	824	10.632
84	1-2-3-4-5-6-7-8-9-12-10-13-11	746	10.451
85	1-3-6-2-4-5-7-8-9-10-13-12-11	860	10.502
86	6-7-3-4-2-1-5-8-9-10-11-12-13	818	10.533
87	2-3-4-1-6-5-7-9-8-10-11-13-12	844	10.555
88	1-2-5-3-7-4-8-9-6-12-10-11-13	853	10.418
89	2-1-3-4-5-6-7-8-9-10-11-12-13	806	10.478
90	2-5-1-4-3-6-7-8-9-10-11-12-13	849	10.570
91	8-6-2-1-5-4-3-7-9-10-11-13-12	715	10.356
92	2-1-3-4-5-6-7-9-8-10-12-13-11	837	10.408
93	2-1-3-4-5-6-7-8-9-10-11-12-13	921	10.440

94	4-1-3-6-7-2-8-5-11-9-10-13-12	763	10.415
95	7-8-2-6-5-4-1-9-3-10-11-12-13	810	10.481
96	2-5-3-7-4-1-6-8-10-9-11-12-13	952	10.463
97	2-1-3-5-4-6-7-8-9-10-12-11-13	956	10.425
98	4-1-2-3-5-6-7-9-8-10-13-11-12	836	10.441
99	1-2-8-3-9-5-7-10-4-12-6-13-11	890	10.517
100	7-5-4-2-1-3-6-8-9-10-11-12-13	859	10.468
Terendah		639	10.293
Tertinggi		997	11.322
Total		82279	1050.560
Rata-Rata		822.79	10.506

Lampiran 5. Hasil *Makespan* Permasalahan Penjadwalan Kombinasi 44 *Job* 34 *Machine* (*Large Scale*) sebanyak 100 *Run*

1. Hasil *Makespan* Algoritma *Pour*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	26-13-42-41-25-40-6-24-2-11-9-3-7-4-34-22-39-37-33-32-15-38-35-31-17-10-30-1-12-21-8-27-5-36-44-18-16-28-20-19-43-14-23-29	5176	3.516
2	31-29-23-40-41-15-9-22-17-35-36-19-10-24-28-16-18-26-32-5-12-13-4-27-20-25-2-34-21-30-6-11-43-7-42-3-37-8-39-1-33-44-38-14	5520	3.461
3	20-13-4-29-11-6-23-30-26-19-27-21-18-1-16-9-37-15-14-43-12-38-33-34-36-2-39-42-31-10-22-41-7-44-5-3-8-25-17-28-40-24-32-35	5428	3.476
4	5-29-28-41-6-35-44-1-37-38-40-33-39-25-18-26-32-7-19-21-36-31-4-11-22-14-17-13-20-12-3-24-16-42-9-43-2-10-23-27-30-8-15-34	5383	3.437
5	18-15-16-5-30-35-32-36-1-22-20-17-23-6-38-41-25-27-7-26-11-14-28-39-19-40-44-2-31-42-12-9-4-3-29-13-33-8-24-34-10-37-43-21	5528	3.461
6	41-25-35-3-43-7-15-38-34-17-13-36-27-19-22-5-6-21-9-33-4-40-20-28-39-23-18-14-29-12-24-32-8-44-2-1-26-42-11-30-37-10-31-16	5480	3.488
7	10-28-36-35-2-29-43-30-34-3-14-5-40-8-6-37-44-41-1-4-19-12-18-17-25-7-42-23-33-31-24-22-27-38-16-13-26-15-9-32-39-11-20-21	5430	3.554
8	23-18-20-12-16-11-22-21-25-26-24-27-28-6-7-40-33-2-43-41-44-9-42-1-5-14-19-13-17-10-29-32-35-36-8-37-30-34-31-4-15-39-3-38	5541	3.562
9	34-44-40-20-21-2-28-19-10-12-8-39-14-1-7-9-43-30-42-16-4-13-11-15-22-32-5-17-29-31-6-35-36-25-18-3-38-33-26-37-41-23-24-27	5334	3.442
10	2-44-5-23-41-43-39-15-42-22-40-14-7-9-17-11-38-33-21-4-16-37-30-28-35-26-18-36-31-24-13-32-29-34-1-20-25-19-8-6-27-3-12-10	5456	3.549
11	43-1-13-3-7-12-6-17-11-18-19-31-25-23-20-16-14-21-4-8-15-38-33-30-29-34-22-40-28-37-24-39-5-41-26-44-9-27-32-42-10-36-2-35	5629	3.468
12	14-9-16-12-15-43-3-28-33-17-30-11-10-13-19-7-37-4-34-35-29-41-39-2-21-1-40-23-42-18-25-26-32-8-24-5-27-6-20-44-36-38-22-31	5634	3.661
13	14-12-10-15-24-25-37-31-35-21-26-34-33-19-23-22-43-30-32-20-36-6-2-29-38-18-16-42-11-27-1-3-44-8-4-5-40-13-9-17-28-41-39-7	5430	3.495

14	14-16-15-42-1-19-18-11-21-2-6-44-4-36-26-17-39-20-25-24-7-37-35-33-27-31-40-9-29-23-43-22-10-38-5-12-3-30-28-32-34-8-13-41	5438	3.472
15	7-22-38-23-27-42-29-34-31-12-41-8-35-14-11-10-15-44-5-3-26-33-30-4-6-13-28-16-40-19-17-18-37-1-20-36-25-21-2-24-9-32-43-39	5475	3.528
16	34-13-21-28-19-6-30-29-36-44-1-27-33-38-17-11-8-25-24-7-43-5-18-16-26-35-20-14-4-10-39-41-9-37-32-23-31-42-40-3-15-12-2-22	5248	3.475
17	17-24-28-30-25-31-27-33-37-43-32-8-35-34-21-9-38-20-42-6-14-13-44-18-7-40-36-2-22-10-4-41-5-12-16-1-39-23-15-11-26-3-19-29	5419	3.461
18	16-34-27-37-29-26-11-28-19-21-7-13-9-32-33-36-30-3-23-42-24-41-31-6-43-1-22-44-10-2-40-35-38-20-25-15-14-12-5-17-39-8-18-4	5529	3.466
19	1-8-44-37-4-23-2-7-10-29-41-12-40-3-6-34-36-5-16-18-13-24-22-35-32-31-42-27-21-15-38-19-20-9-33-43-14-28-39-26-17-25-11-30	5736	3.523
20	18-34-43-28-36-3-8-1-19-11-17-16-15-14-39-10-31-21-25-32-4-26-5-29-9-42-30-27-35-13-44-37-20-6-23-12-2-22-7-24-38-40-33-41	5322	3.493
21	27-22-18-1-41-34-20-19-31-37-21-23-43-4-17-14-7-32-35-26-29-33-25-5-10-28-11-12-9-40-2-3-38-44-6-15-30-24-36-8-13-16-42-39	5406	3.575
22	41-12-18-20-36-26-33-35-22-25-32-39-37-24-43-27-31-28-5-1-4-7-17-2-23-40-21-15-34-14-8-9-44-13-30-42-11-29-3-6-10-16-38-19	5426	3.452
23	44-7-1-2-39-28-14-38-21-20-32-31-34-33-13-9-4-35-41-12-19-18-24-3-42-43-17-8-26-15-23-30-25-11-10-6-37-29-36-5-22-40-27-16	5428	3.475
24	33-36-27-23-34-32-17-14-25-9-19-7-6-15-12-2-22-8-16-26-31-44-30-38-39-28-18-13-11-20-21-10-5-24-3-4-43-29-35-37-42-1-40-41	5467	3.451
25	10-43-6-14-21-34-37-22-7-15-23-25-12-9-18-4-17-28-26-2-32-3-5-1-13-44-41-40-11-36-8-31-42-16-35-27-24-19-33-38-39-30-20-29	5207	3.561
26	38-29-35-39-42-37-31-36-23-27-8-25-28-17-22-2-44-21-7-13-15-16-18-12-43-30-24-33-32-41-4-14-9-10-5-11-1-40-20-3-34-19-6-26	5561	3.498
27	17-5-1-9-43-6-44-41-18-26-20-19-22-12-16-8-21-40-23-35-10-31-2-28-36-34-24-11-25-32-39-33-27-30-29-42-37-4-14-13-7-38-15-3	5399	3.339
28	38-25-22-18-2-44-37-7-34-12-35-42-39-6-4-3-10-15-8-19-31-21-40-30-28-5-33-20-9-27-29-24-36-26-32-41-43-23-1-17-16-13-14-11	5416	3.443
29	7-2-44-42-39-41-4-5-1-38-10-24-14-40-36-35-43-15-28-34-27-37-19-16-8-9-30-31-13-21-17-26-3-22-23-12-11-18-33-6-29-25-20-32	5263	3.581

30	4-17-14-33-10-3-9-8-6-11-44-7-12-43-32-30-28-16-27-20-26-19-29-38-23-40-31-25-1-22-24-21-18-5-34-36-42-39-13-2-35-41-37-15	5353	3.396
31	16-24-15-18-2-44-6-4-39-8-30-40-36-34-38-10-35-11-20-19-21-23-13-32-33-28-31-41-7-17-3-37-29-25-27-5-43-26-14-1-12-22-42-9	5472	3.621
32	3-10-9-8-2-26-44-6-22-36-21-5-12-4-24-18-32-40-19-23-41-29-34-25-42-38-37-39-43-27-13-1-35-7-11-14-15-16-30-17-28-31-33-20	5480	3.457
33	8-38-44-39-30-33-34-27-23-9-22-7-13-12-15-5-4-19-24-32-11-14-40-37-6-2-42-21-16-10-36-26-29-43-1-25-20-28-31-41-35-3-18-17	5358	3.478
34	25-37-32-4-3-1-30-39-35-34-28-6-9-27-20-38-40-7-12-18-44-43-15-21-17-26-31-2-11-19-5-8-42-10-16-41-24-13-36-23-33-14-22-29	5410	3.409
35	38-1-2-6-26-27-23-24-17-22-25-16-32-10-18-4-42-9-39-14-37-29-8-31-33-3-20-21-5-11-34-19-13-7-15-30-28-35-40-43-44-36-12-41	5250	3.445
36	15-4-6-8-7-9-32-31-39-30-36-35-34-40-28-42-14-41-26-43-16-17-1-18-33-44-23-22-29-20-21-12-3-19-37-27-25-10-24-13-2-11-38-5	5275	3.528
37	29-34-37-15-17-21-31-18-28-23-20-19-24-12-10-5-16-26-22-3-4-41-13-35-27-44-14-33-6-7-32-1-38-40-8-9-30-36-25-43-39-2-11-42	5351	3.438
38	33-32-35-20-21-31-14-9-6-5-10-24-18-15-12-16-30-3-1-19-42-44-43-22-23-25-40-34-26-17-28-39-4-37-41-7-38-8-11-36-13-27-29-2	5382	3.572
39	11-8-4-41-35-22-21-20-30-23-25-36-32-34-42-38-44-24-29-17-31-43-10-33-9-13-14-1-6-5-7-3-39-37-19-12-40-16-28-27-15-18-2-26	5324	3.445
40	23-34-42-2-6-21-11-28-24-33-5-15-14-20-7-18-22-35-37-44-38-36-3-17-43-19-26-10-8-4-30-27-31-12-1-25-9-13-29-39-32-40-41-16	5222	3.513
41	44-42-6-4-1-19-16-34-8-32-23-21-3-28-39-7-36-35-31-43-12-9-10-2-18-5-11-38-37-13-17-22-15-27-30-25-29-14-40-26-33-41-24-20	5250	3.451
42	14-43-34-35-26-4-44-3-2-9-29-24-21-10-8-32-39-37-13-40-38-36-22-17-42-1-25-20-15-30-7-5-6-19-23-41-12-11-31-33-16-28-27-18	5219	3.443
43	25-42-34-40-28-33-29-2-10-36-30-24-35-6-38-41-21-27-14-32-5-16-15-13-12-11-22-1-3-39-26-19-9-23-18-7-37-31-43-20-44-17-8-4	5529	3.360
44	35-33-12-13-11-43-42-32-17-25-36-39-21-14-22-24-34-10-20-18-9-2-19-40-26-37-27-31-4-6-5-7-38-1-28-44-29-16-41-15-8-3-23-30	5419	3.618
45	6-5-4-34-1-13-18-16-12-41-20-8-25-15-14-43-19-24-30-7-40-28-26-22-27-31-37-17-32-29-39-35-33-9-21-23-36-38-2-42-11-3-10-44	5078	3.558

46	26-9-13-36-42-35-44-41-30-39-1-43-4-12-37-32-40-5-7-27-29-38-21-15-20-18-19-17-2-6-31-16-10-24-28-25-33-8-3-14-11-34-23-22	5233	3.466
47	31-8-35-25-22-23-26-37-36-24-32-28-12-9-15-3-5-14-42-18-21-19-17-16-13-1-40-34-27-20-39-11-30-10-44-41-2-33-38-43-4-7-29-6	5216	3.667
48	43-35-42-31-18-6-8-7-23-21-19-15-36-9-11-3-20-5-24-17-12-14-16-40-34-32-25-13-2-30-28-44-41-26-1-27-29-33-38-10-37-22-39-4	5524	3.578
49	7-25-42-38-1-44-26-3-32-34-19-35-43-22-4-24-28-29-20-5-33-15-36-13-27-6-18-12-11-17-16-30-9-8-41-10-14-37-31-23-40-21-39-2	5325	3.476
50	24-13-23-27-22-1-2-17-3-30-11-32-31-5-28-37-35-38-41-44-9-21-43-33-8-25-34-42-29-39-10-26-40-4-16-19-6-18-7-20-14-12-15-36	5620	3.449
51	23-41-16-28-2-26-30-5-35-32-22-1-44-19-9-7-10-40-6-39-17-3-15-11-43-4-31-37-8-38-27-12-14-24-18-20-42-21-25-33-29-34-36-13	5341	3.502
52	20-24-13-35-33-32-19-10-17-16-28-37-30-29-26-25-1-18-7-22-9-23-3-14-43-6-11-41-44-27-42-5-36-2-8-15-4-21-39-31-34-12-38-40	5457	3.455
53	27-15-21-8-31-9-18-42-38-39-1-12-40-6-11-34-26-19-16-10-20-23-36-2-7-4-43-33-29-3-37-25-17-24-13-5-28-22-44-41-32-14-30-35	5427	3.498
54	37-35-11-7-10-5-6-8-21-15-13-18-44-12-2-19-22-27-23-42-25-43-41-33-1-32-9-4-17-3-14-34-16-24-20-28-31-36-38-26-30-39-40-29	5554	3.486
55	28-7-40-34-31-32-5-1-8-43-6-24-23-22-13-36-39-21-16-25-26-42-2-37-11-41-10-30-4-35-27-33-29-3-12-38-44-9-19-14-18-20-15-17	5453	3.479
56	44-8-11-43-42-27-24-13-21-39-31-32-29-37-25-15-28-19-23-18-20-22-33-38-16-41-3-5-40-34-10-6-26-14-2-7-30-4-9-12-17-35-1-36	5488	3.470
57	29-5-43-10-13-3-2-6-1-7-36-27-31-30-32-34-22-33-21-19-42-39-38-37-35-8-9-20-40-4-41-24-15-16-23-28-11-12-17-25-44-26-18-14	5479	3.602
58	37-19-38-43-44-40-16-39-42-6-7-15-22-24-28-26-27-29-30-18-36-31-21-34-17-33-9-14-23-32-11-10-8-25-4-5-12-13-1-2-20-35-41-3	5430	3.460
59	11-44-5-15-16-18-9-1-14-13-17-27-25-24-20-30-22-26-33-4-39-40-3-32-23-35-29-36-28-38-10-43-12-7-8-19-41-2-6-37-21-42-31-34	5389	3.447
60	10-19-25-34-27-35-37-39-42-38-24-26-36-40-2-29-12-18-16-5-44-32-15-6-14-41-31-11-20-17-22-3-7-23-30-33-1-43-21-9-4-28-8-13	5248	3.567
61	36-39-37-38-2-17-23-43-4-10-9-20-14-1-5-41-11-31-30-32-44-6-18-15-12-40-33-22-24-29-7-19-16-28-34-8-27-13-3-21-25-26-35-42	5303	3.506

62	17-16-14-13-19-9-15-10-7-4-31-6-32-5-34-3-43-26-41-42-44-25-38-8-29-37-18-30-1-2-27-28-35-39-33-12-11-20-21-22-23-36-40-24	5273	3.502
63	29-16-12-4-32-13-30-39-28-18-37-34-31-35-3-11-38-33-25-22-26-1-24-36-8-7-17-6-9-20-2-40-41-10-15-23-44-43-27-14-5-21-42-19	5568	3.409
64	40-18-33-29-13-30-20-35-26-24-4-9-1-3-2-43-17-15-12-11-5-44-21-34-22-10-25-31-23-14-37-8-41-28-7-42-16-27-38-19-39-6-32-36	5466	3.579
65	36-40-31-23-24-22-19-28-8-43-6-32-18-5-17-15-16-10-7-13-14-12-26-27-39-44-25-3-4-33-34-29-1-30-21-2-20-37-38-42-41-35-9-11	5176	3.439
66	17-12-11-3-40-5-20-25-1-21-14-15-27-29-31-23-16-42-38-32-22-7-41-43-18-10-9-19-4-2-35-6-44-33-26-8-36-28-34-30-24-13-37-39	5394	3.584
67	8-7-10-25-19-20-21-26-9-4-3-2-29-30-31-34-23-22-38-39-33-43-12-24-27-42-35-36-37-44-14-15-16-32-28-41-5-6-13-17-18-1-40-11	5449	3.474
68	16-6-5-36-9-32-26-18-44-14-15-30-33-20-28-35-31-27-42-41-25-34-24-7-19-29-2-8-21-4-13-17-39-37-12-11-43-10-40-38-22-23-3-1	5434	3.566
69	33-18-26-37-39-28-20-44-43-4-7-9-21-25-16-2-34-19-31-41-32-38-36-24-10-11-42-27-17-5-12-1-15-13-29-3-8-23-14-35-40-22-6-30	5198	3.681
70	33-14-29-41-3-30-43-40-44-18-17-10-21-12-9-16-15-37-31-26-5-13-2-7-19-38-1-32-4-27-42-22-28-34-6-24-35-8-36-20-11-39-25-23	5298	3.451
71	1-28-38-13-36-34-42-26-37-2-12-15-11-10-4-23-29-22-19-21-27-33-44-32-5-7-9-3-39-43-40-6-31-18-30-8-24-25-35-16-41-14-20-17	5546	3.484
72	39-38-30-4-25-20-6-36-29-43-19-18-11-9-3-8-44-40-37-42-12-21-10-7-14-23-1-5-17-33-35-26-31-32-13-28-27-34-15-2-22-24-41-16	5472	3.600
73	18-22-25-40-14-35-44-27-11-12-20-7-41-16-2-39-34-28-26-29-17-36-24-38-23-33-32-37-1-19-31-43-42-13-10-5-9-6-21-8-15-4-3-30	5234	3.456
74	11-12-17-18-21-10-31-9-13-24-7-29-26-28-30-35-36-37-38-44-2-5-23-43-19-34-27-22-42-3-8-14-25-32-20-15-4-16-33-40-1-39-41-6	5443	3.539
75	11-10-13-19-23-22-12-40-15-43-31-27-36-30-3-42-41-24-21-34-1-20-26-44-4-2-5-37-38-32-6-28-29-35-25-14-8-16-18-7-9-39-17-33	5400	3.500
76	18-17-1-23-42-2-21-38-39-35-36-33-40-30-4-5-6-7-3-8-13-11-12-15-44-26-27-9-28-34-29-31-37-43-22-19-10-20-16-14-24-41-25-32	5374	3.593
77	42-17-1-4-44-12-14-13-31-43-33-8-10-15-35-2-3-18-6-28-29-26-36-27-23-20-34-7-19-40-5-25-24-41-21-16-30-38-32-37-9-22-11-39	5358	3.429

78	13-11-18-8-1-4-10-12-17-43-31-41-38-21-3-29-30-23-20-32-22-7-44-15-42-2-34-36-37-33-25-14-16-6-40-19-35-39-9-26-24-28-27-5	5547	3.537
79	35-34-39-30-24-25-27-28-1-40-44-2-26-36-19-20-13-42-5-38-31-16-22-18-12-21-10-7-37-6-3-29-4-15-17-9-14-32-23-33-41-43-8-11	5472	3.464
80	31-34-1-27-32-36-38-40-37-33-42-2-26-25-13-44-9-14-11-18-19-43-21-8-12-22-7-3-17-5-6-16-10-23-20-28-39-29-41-30-24-4-35-15	5314	3.483
81	36-24-6-22-23-2-5-41-25-39-14-27-26-28-29-4-3-10-35-9-8-13-12-17-16-34-40-1-32-37-18-15-19-20-21-30-7-42-33-38-44-11-31-43	5382	3.479
82	34-33-30-43-42-5-44-41-39-37-19-25-31-21-20-15-14-13-18-12-10-35-29-24-27-28-26-2-32-6-16-11-23-8-22-36-40-4-38-17-7-3-9-1	5337	3.497
83	14-16-42-19-43-24-29-18-28-17-32-35-22-8-44-7-33-3-5-36-38-40-30-34-15-31-27-2-6-26-37-41-9-20-10-21-11-12-25-4-13-39-23-1	5227	3.589
84	29-43-36-10-33-5-11-1-18-38-42-21-39-15-14-3-8-6-23-34-28-27-31-30-35-9-41-32-40-7-19-16-12-25-22-4-2-24-26-44-37-17-20-13	5431	3.462
85	41-27-42-33-44-39-9-18-10-13-12-38-14-23-37-24-2-1-11-35-21-31-29-26-28-43-6-8-36-4-19-5-16-25-17-20-40-15-3-32-22-7-30-34	5468	3.444
86	5-16-8-10-43-42-18-22-31-28-25-19-40-7-6-39-23-26-32-35-21-30-14-20-27-13-38-11-2-17-1-33-9-29-24-15-4-36-41-44-3-34-37-12	5259	3.544
87	39-1-11-6-4-7-9-21-20-24-23-18-28-36-16-17-5-8-43-25-27-29-37-42-44-31-19-22-2-30-33-12-15-3-40-32-34-26-10-13-35-14-38-41	5349	3.439
88	41-8-12-4-11-19-10-27-26-31-32-15-7-28-6-40-14-43-42-44-21-22-37-25-23-39-30-38-35-16-29-34-1-20-24-2-9-17-3-18-33-36-13-5	5656	3.587
89	22-3-24-28-35-37-43-25-4-44-40-1-19-26-30-39-17-32-29-41-42-7-2-11-34-16-31-15-13-5-18-10-36-14-27-21-38-9-6-8-12-20-23-33	5348	3.677
90	7-9-29-25-5-12-42-15-26-35-19-27-34-44-32-31-38-28-2-30-21-23-22-41-40-43-36-17-14-8-13-1-37-3-16-10-4-39-6-20-33-11-18-24	5478	3.483
91	28-39-27-2-25-1-20-41-21-18-30-31-35-32-29-37-33-26-40-14-43-22-17-16-8-23-13-3-5-44-6-36-4-19-9-38-24-7-11-34-42-15-12-10	5494	3.612
92	28-34-37-40-31-35-38-39-11-5-13-17-16-18-10-44-33-26-21-7-6-1-25-15-22-4-42-20-24-27-41-9-43-14-36-2-23-12-32-29-30-3-19-8	5241	3.459
93	7-14-16-5-15-6-43-12-2-11-8-9-33-1-19-21-25-31-34-36-38-37-28-20-30-35-39-26-27-29-41-23-22-13-18-24-40-10-4-32-42-17-44-3	5627	3.491

94	36-40-9-14-8-10-1-4-34-6-5-42-2-19-17-32-27-18-29-38-15-33-3-37-26-16-25-13-20-11-7-41-23-28-43-30-31-22-39-12-24-21-44-35	5423	3.492
95	16-34-7-13-43-8-17-15-20-19-33-36-29-6-40-38-25-1-31-23-11-2-10-12-26-5-9-14-3-27-4-28-42-24-39-32-30-37-35-41-21-22-18-44	5380	3.590
96	41-37-39-35-4-5-8-7-43-6-19-24-11-29-33-38-25-26-1-3-44-36-42-13-12-20-22-17-18-28-16-2-23-32-14-9-10-30-27-31-34-15-40-21	5282	3.468
97	5-16-6-11-15-17-19-7-14-4-43-13-12-10-18-2-9-24-25-3-33-36-20-37-38-34-35-44-30-32-26-29-39-21-42-1-22-31-8-27-41-40-28-23	5439	3.616
98	42-11-4-10-28-17-9-30-39-33-6-12-16-31-25-26-24-35-37-22-2-40-13-38-21-19-18-14-1-44-43-27-29-7-8-36-41-5-20-32-34-23-3-15	5373	3.430
99	28-6-10-2-40-29-27-42-9-12-7-15-5-33-25-30-34-21-23-37-41-3-4-36-1-44-39-18-13-14-26-32-22-20-17-8-11-38-16-19-31-24-35-43	5430	3.411
100	7-10-24-19-30-32-21-27-1-34-6-41-2-37-9-44-15-38-17-13-16-23-20-25-31-28-3-5-14-11-29-35-33-18-22-8-26-36-4-12-40-42-43-39	5474	3.537
Terendah		5078	3.339
Tertinggi		5736	3.681
Total		540082	350.277
Rata-Rata		5400.82	3.503

2. Hasil *Makespan* Algoritma NST

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	1-2-4-3-5-6-7-8-9-10-11-12-13-14-15-17-16-18-20-19-21-22-23-25-24-26-27-28-29-30-32-33-35-34-31-36-37-38-39-40-42-41-43-44	5368	1.516
2	2-1-3-4-5-6-7-8-9-10-12-11-14-13-15-16-18-17-19-20-22-21-24-23-25-27-26-28-29-30-31-32-33-34-35-36-38-39-37-40-41-42-43-44	5333	1.212
3	1-2-3-4-5-6-8-9-7-10-11-12-13-16-14-15-17-18-19-20-21-22-23-24-25-26-27-28-30-29-31-32-34-33-38-36-35-37-39-40-42-43-41-44	5105	1.532
4	3-4-2-1-7-5-6-9-8-11-13-10-14-12-15-17-16-19-18-21-20-23-24-22-26-25-27-30-28-31-29-32-33-34-35-37-36-39-40-38-42-41-43-44	5289	2.969
5	1-3-2-4-5-6-7-8-9-10-11-12-14-13-15-16-17-18-19-20-21-22-23-26-24-25-27-28-29-30-31-32-33-34-35-36-37-38-39-41-40-42-43-44	5224	0.768
6	3-1-4-2-5-6-7-8-9-11-10-12-13-14-15-16-17-18-20-19-21-23-22-24-25-26-27-29-28-30-31-32-33-34-35-36-37-38-39-40-41-43-42-44	5239	1.305
7	1-2-4-3-6-5-7-9-8-11-10-12-13-14-16-15-17-18-19-20-21-22-23-24-25-27-26-28-29-30-31-32-33-34-35-36-38-37-39-44-40-41-42-43	5275	1.393
8	1-6-2-4-3-5-7-8-9-11-10-12-13-14-16-15-17-18-20-19-21-23-24-22-26-25-27-28-29-30-31-34-35-32-33-37-36-38-40-39-41-42-43-44	5148	2.029
9	2-3-1-4-5-7-6-8-10-9-11-12-14-13-15-16-17-18-19-20-21-23-22-24-25-27-29-28-26-30-31-33-32-35-36-34-39-37-38-40-41-42-43-44	5197	1.823
10	2-4-3-1-5-6-7-9-8-11-10-12-13-14-15-16-17-18-19-21-20-23-22-24-26-25-27-28-30-29-31-32-34-33-35-36-38-37-41-39-40-42-43-44	5159	1.737
11	1-3-6-5-2-4-8-9-7-10-12-11-13-14-15-16-18-17-22-21-19-23-20-24-25-27-26-28-29-32-30-31-33-34-35-36-37-39-38-40-41-42-43-44	5439	2.375
12	3-2-1-5-4-6-7-10-8-9-11-13-12-14-15-16-17-19-18-20-21-22-23-24-25-26-27-29-28-31-30-32-33-34-36-35-38-39-37-40-41-42-43-44	5244	1.662
13	2-1-3-4-6-5-7-8-10-9-11-12-16-14-13-17-18-15-19-22-20-23-21-24-25-27-26-28-30-31-29-32-34-33-36-35-37-38-39-40-42-41-43-44	5138	2.172
14	1-4-3-2-6-5-7-8-9-10-12-11-13-14-17-15-16-18-20-19-21-23-22-25-24-26-28-27-29-30-32-31-33-34-35-36-39-37-38-41-42-40-44-43	5343	2.042
15	1-2-3-4-6-5-7-10-8-9-12-11-13-14-15-16-17-18-20-19-22-21-23-24-26-25-27-28-29-30-31-32-33-35-34-38-36-37-39-41-40-42-43-44	5271	1.395

16	2-1-3-4-5-6-8-7-9-10-11-14-12-15-13-16-17-18-19-20-24-21-22-23-27-25-26-30-28-32-29-31-33-35-34-36-38-37-40-39-41-44-42-43	5357	2.268
17	1-2-3-5-4-7-6-8-10-9-12-13-11-14-15-17-18-19-16-20-21-23-22-24-25-26-27-28-30-32-29-31-33-34-36-35-37-38-39-40-41-43-42-44	5296	1.727
18	1-2-3-5-7-4-6-8-9-11-12-15-10-13-14-17-16-18-19-20-21-22-23-24-27-25-26-28-29-30-31-33-32-34-35-36-37-38-40-39-41-42-44-43	5332	1.708
19	1-2-4-3-6-5-7-8-9-10-11-13-12-14-15-16-17-18-19-22-20-21-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-44-42-43	5296	0.972
20	1-3-5-2-4-6-7-8-9-10-11-13-12-14-16-17-18-15-19-20-23-22-24-21-25-26-27-28-29-30-31-33-32-34-35-36-37-38-39-40-41-42-43-44	5317	1.516
21	1-2-3-6-4-5-7-9-8-10-11-14-13-12-15-17-18-16-19-20-22-21-23-24-25-26-27-28-29-30-31-32-33-35-34-36-37-38-39-40-41-43-44-42	5271	1.526
22	2-1-3-4-5-6-7-8-9-10-11-12-15-13-17-14-16-18-21-19-20-22-23-24-26-25-27-28-29-30-31-32-34-33-35-36-37-38-42-40-39-43-44-41	5250	1.847
23	1-2-3-4-7-5-6-9-10-8-11-12-13-14-15-16-17-20-19-21-18-22-23-24-25-26-27-28-29-30-31-33-32-35-34-36-37-38-39-40-41-43-42-44	5235	1.401
24	2-1-3-4-6-5-7-8-10-9-11-12-13-14-15-16-17-19-21-23-18-20-22-24-25-26-27-28-29-31-30-33-34-36-32-35-38-37-39-44-42-40-43-41	5226	2.612
25	1-2-3-4-6-8-5-7-10-9-11-12-13-14-15-16-17-18-21-19-23-20-22-24-25-26-27-28-29-30-31-32-33-34-36-35-37-38-39-40-41-42-43-44	5187	1.184
26	2-1-3-4-6-5-7-9-8-10-11-12-13-14-15-16-17-18-19-21-20-23-22-26-24-28-25-27-29-30-31-32-34-33-36-37-35-38-41-40-39-44-42-43	5415	2.042
27	1-3-2-5-4-6-7-8-10-9-12-13-14-15-11-16-17-19-18-21-20-22-23-24-27-25-26-28-29-31-34-32-30-33-37-35-36-38-39-41-40-43-42-44	5245	2.946
28	2-4-3-1-5-6-7-8-9-10-11-12-15-13-14-16-17-18-19-20-21-24-22-26-25-23-27-28-29-31-32-30-33-34-37-35-38-36-39-40-41-42-43-44	5274	1.984
29	2-1-3-4-5-6-7-8-10-9-13-11-12-15-14-16-18-17-19-20-21-22-23-26-24-28-27-25-29-31-30-33-32-34-35-36-37-38-39-40-44-43-41-42	5190	2.191
30	1-3-4-2-5-7-6-8-9-10-11-12-13-14-15-16-17-18-19-20-21-23-22-25-26-24-28-29-27-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44	5198	1.113
31	4-2-3-1-6-7-5-10-8-12-9-11-13-14-15-17-18-16-19-20-21-22-23-24-25-26-27-28-29-30-32-31-33-35-34-36-37-38-41-39-40-43-44-42	5264	2.313

32	1-2-3-4-5-6-8-7-9-10-12-11-13-14-15-16-17-21-18-22-20-19-24-23-25-26-27-28-29-30-31-32-35-33-34-36-38-39-37-40-42-41-44-43	5278	1.882
33	1-2-4-3-5-6-7-8-9-10-12-11-13-14-15-16-17-18-19-20-21-22-23-26-24-25-29-27-28-30-31-33-32-35-34-36-37-38-39-40-41-42-43-44	5189	1.087
34	1-3-2-4-5-6-7-8-9-10-11-12-13-14-15-16-17-19-18-20-21-23-22-24-26-29-25-27-28-30-31-32-33-34-36-35-38-37-39-40-42-41-43-44	5320	1.322
35	1-2-4-3-5-6-7-10-8-12-9-11-15-13-14-16-17-18-19-20-21-22-24-23-25-26-27-28-29-31-30-32-33-34-36-35-37-39-38-40-41-42-44-43	5115	1.513
36	1-2-3-4-6-5-8-7-10-9-11-12-13-14-15-17-18-16-19-21-20-23-22-26-24-27-29-25-28-31-30-32-33-34-35-36-37-38-39-40-41-42-43-44	5195	1.696
37	1-5-2-3-6-7-4-8-9-10-11-13-12-14-16-17-15-18-19-20-22-21-23-25-24-26-28-29-27-30-32-31-33-34-35-36-37-38-39-41-40-43-42-44	5152	1.872
38	1-3-4-2-5-6-8-7-9-10-11-12-13-15-17-14-16-18-19-21-20-22-24-23-25-26-28-27-29-30-31-33-32-34-35-36-37-38-40-39-41-43-42-44	5242	1.519
39	4-3-5-2-1-7-6-9-8-12-10-11-13-14-15-17-16-21-18-19-20-22-24-25-26-23-27-29-28-30-32-31-33-35-34-36-37-38-39-43-40-41-42-44	5067	2.942
40	1-2-3-4-5-6-7-8-9-10-11-13-12-14-15-17-16-19-18-20-21-22-23-25-24-26-28-27-29-30-31-32-34-33-35-36-38-37-40-39-41-43-42-44	5203	1.177
41	1-2-3-4-5-6-8-7-9-11-10-12-13-14-15-17-16-18-19-20-21-22-24-23-25-26-27-29-28-30-31-33-32-34-36-35-37-38-39-40-41-44-42-43	5129	1.316
42	1-3-4-2-5-6-7-8-10-9-12-11-14-17-13-16-15-18-20-19-21-23-22-24-25-26-27-29-28-32-30-31-33-34-36-35-38-40-37-39-41-42-44-43	5278	2.371
43	2-4-3-1-5-6-7-8-9-10-11-13-12-14-17-15-16-18-19-20-21-22-23-24-25-26-28-27-29-30-31-35-32-34-36-39-33-37-38-40-41-42-43-44	5213	2.206
44	1-2-5-3-4-8-6-7-11-9-10-13-12-16-14-15-17-18-19-21-20-22-23-24-27-25-26-28-29-30-31-32-33-34-35-36-37-38-39-40-42-41-44-43	5068	1.759
45	2-1-5-6-4-8-3-7-9-10-11-12-13-14-15-16-17-18-19-20-22-24-21-23-25-26-28-27-29-30-31-32-33-36-34-37-38-35-40-39-41-42-43-44	5034	2.076
46	1-4-3-2-5-6-8-7-11-10-9-12-13-16-14-17-18-15-19-21-20-22-23-26-27-24-25-29-28-30-31-32-33-34-35-41-36-37-38-40-42-39-43-44	5267	3.091
47	1-2-3-5-4-6-7-8-10-9-11-12-14-13-15-17-16-18-20-19-21-22-24-23-25-26-27-28-29-30-31-32-33-34-35-37-36-38-39-40-41-42-43-44	5281	0.969

48	3-5-1-2-6-7-4-8-10-9-11-12-14-13-15-16-17-18-21-19-20-22-23-24-25-26-27-28-29-31-32-30-34-33-35-36-37-39-38-40-41-44-42-43	5400	2.066
49	1-3-2-4-5-6-7-8-11-9-10-14-13-12-16-18-15-17-19-20-21-22-23-24-25-26-28-27-29-31-32-30-33-34-36-35-37-38-39-40-41-42-44-43	5290	1.762
50	1-2-4-3-5-6-8-7-9-10-13-11-12-14-16-17-15-18-20-21-19-23-22-25-24-26-27-28-30-31-29-32-33-35-36-34-38-37-40-41-39-44-43-42	4949	2.343
51	1-2-3-4-5-6-7-9-8-10-12-14-11-13-15-16-17-18-19-20-21-22-23-24-27-25-29-26-28-30-34-32-31-35-33-36-37-38-40-39-42-41-43-44	5093	1.869
52	1-4-2-3-6-5-7-9-8-10-11-12-15-14-13-17-18-16-20-19-22-21-23-25-24-26-27-28-30-29-31-33-32-35-36-37-34-38-39-40-44-41-43-42	5212	2.495
53	1-2-3-4-6-7-5-8-9-10-11-12-13-15-14-16-17-18-19-20-21-22-24-23-25-26-27-28-30-29-32-31-33-35-34-36-38-37-39-40-41-42-43-44	5226	1.073
54	2-1-3-4-5-6-10-7-9-8-13-12-11-14-15-17-16-18-20-21-19-24-22-25-23-26-27-29-30-28-32-31-33-34-37-35-36-39-38-40-41-42-43-44	5355	2.463
55	1-2-4-3-5-6-7-8-9-11-10-12-14-13-15-17-16-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-35-34-38-36-37-39-40-41-42-44-43	5165	1.230
56	1-3-2-4-5-6-7-8-9-10-11-14-12-13-15-16-19-17-18-20-21-24-22-25-23-27-26-28-29-30-31-32-33-34-35-37-36-38-39-41-40-42-43-44	5410	1.430
57	1-2-3-4-5-6-7-8-9-10-12-11-13-14-15-17-16-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-36-35-37-38-39-40-42-41-43-44	5389	0.655
58	1-2-3-4-6-5-7-10-8-9-11-12-14-13-15-16-17-18-19-20-22-21-23-24-25-26-28-27-30-29-31-32-34-33-36-35-37-38-40-39-41-43-42-44	5419	1.431
59	1-3-2-4-5-6-7-8-9-10-12-14-11-15-13-16-17-18-19-20-22-21-25-24-23-27-29-26-28-32-30-31-33-37-34-35-36-39-38-40-42-41-43-44	5392	2.309
60	1-2-3-4-5-6-7-8-9-10-12-11-13-14-15-17-18-16-19-20-21-22-25-23-24-26-27-28-29-30-32-31-34-36-33-35-37-39-38-40-41-43-42-44	5306	1.430
61	2-1-3-5-4-9-6-7-8-11-12-10-13-16-14-17-15-20-18-21-19-24-22-23-25-26-27-29-28-30-31-32-33-34-35-36-37-40-38-39-42-41-43-44	5171	2.331
62	1-2-3-4-5-6-7-8-9-11-10-12-13-14-15-16-17-19-18-21-20-22-25-24-23-26-27-28-29-30-31-32-33-34-35-37-36-39-38-40-42-43-41-44	5553	1.314
63	1-2-3-4-5-6-7-8-9-11-10-12-13-14-15-16-17-18-19-20-22-21-23-24-25-27-26-28-29-30-34-31-33-32-35-37-36-38-40-39-41-44-42-43	5417	1.441

64	1-3-2-4-6-7-5-8-9-11-12-13-10-14-17-16-15-18-19-20-21-22-24-23-25-27-26-30-28-33-29-31-32-34-37-35-38-36-40-42-39-41-43-44	5156	2.623
65	1-2-4-3-5-6-7-9-8-10-11-13-12-14-15-16-17-18-19-21-20-22-24-23-25-26-27-29-28-32-30-31-33-35-34-36-37-40-39-38-42-41-44-43	5283	1.771
66	1-3-2-4-6-8-5-7-9-12-10-11-14-15-16-13-17-19-18-20-21-23-22-24-27-25-29-26-28-30-31-32-33-34-36-35-38-37-39-40-41-42-44-43	5144	2.188
67	1-2-3-4-7-5-8-9-10-6-11-13-12-14-15-16-17-18-19-20-21-22-23-24-25-26-28-27-29-30-31-33-34-32-35-36-37-38-40-43-39-41-42-44	5417	1.698
68	2-3-1-4-5-6-7-8-9-12-10-11-13-14-15-16-18-17-20-19-23-21-24-22-25-26-27-28-30-29-31-33-32-35-36-34-37-39-38-41-40-42-43-44	5419	2.079
69	2-4-1-3-5-7-6-8-9-10-11-12-13-14-15-16-17-18-20-19-22-21-23-24-25-26-28-27-29-30-31-33-34-32-35-36-37-39-38-40-41-42-43-44	5230	1.317
70	1-2-3-5-4-6-7-8-9-11-10-12-14-16-13-18-15-20-17-19-21-22-24-23-25-26-27-30-28-31-29-33-34-32-35-36-37-40-38-39-42-41-43-44	5288	2.296
71	1-2-3-4-5-7-6-8-9-10-11-12-13-14-16-15-17-18-20-19-21-22-24-23-26-25-27-28-30-29-31-32-33-34-35-36-37-39-38-40-42-41-43-44	5379	1.090
72	3-1-2-4-5-7-8-6-9-10-11-13-12-15-14-17-18-16-19-20-22-21-23-24-26-25-28-27-30-29-31-32-33-36-37-34-39-38-35-41-43-42-40-44	5249	2.703
73	2-1-3-5-4-8-6-7-10-9-11-12-14-15-13-16-17-18-19-20-21-22-23-24-26-25-27-29-28-30-32-31-33-34-36-35-38-37-39-40-41-43-42-44	5219	1.610
74	2-3-1-4-5-7-6-8-9-11-12-10-13-14-15-16-17-18-19-20-22-21-23-24-25-26-27-28-30-29-31-32-33-34-35-36-37-38-40-39-41-43-42-44	5309	1.228
75	3-1-2-4-5-6-7-9-8-10-12-11-13-14-15-16-17-18-21-20-22-19-23-25-26-24-27-28-30-29-32-33-31-34-35-36-37-39-38-40-41-43-44-42	5281	2.410
76	1-3-2-4-5-7-6-8-10-11-14-9-12-15-13-16-18-17-20-19-22-21-24-23-26-27-25-29-28-31-30-33-32-34-36-35-37-38-41-40-39-42-43-44	5261	2.517
77	1-2-3-4-5-7-6-8-9-10-11-12-14-13-15-16-17-18-20-19-21-23-25-22-24-27-26-29-30-31-28-32-33-34-35-36-37-38-39-40-41-43-42-44	5354	1.420
78	1-2-3-5-4-6-7-9-8-10-11-13-12-14-15-16-17-18-19-21-20-23-22-24-25-26-27-28-29-30-31-32-33-34-35-36-37-39-40-38-41-42-43-44	5457	0.978
79	1-3-2-5-4-6-8-9-7-11-10-12-13-14-15-17-16-18-19-20-21-22-23-24-25-26-28-27-29-30-32-34-33-31-36-35-37-38-40-39-41-42-44-43	5135	1.771

80	1-2-3-5-6-4-7-9-8-10-11-12-14-13-15-16-17-18-20-19-22-21-24-23-25-26-28-27-29-30-31-33-34-32-35-36-37-39-38-40-41-42-44-43	5063	1.531
81	2-3-1-4-6-5-8-10-7-9-11-12-13-14-15-17-16-18-19-20-21-22-23-24-25-26-27-28-29-30-31-33-32-35-34-36-37-38-40-39-41-42-44-43	5079	1.425
82	2-1-3-4-5-6-7-8-9-10-11-12-13-15-14-16-17-19-18-20-21-22-23-25-26-27-24-28-31-30-29-32-34-33-35-38-37-36-40-39-42-41-43-44	5441	1.840
83	2-4-3-5-1-9-6-7-8-10-11-12-14-13-15-16-17-18-19-22-20-25-23-26-21-27-28-24-30-29-32-31-33-34-35-36-37-39-40-38-41-42-44-43	5118	2.839
84	1-2-3-4-5-6-7-9-8-10-11-12-13-14-15-17-16-19-18-22-20-21-23-24-25-27-30-26-28-29-33-31-35-34-37-32-36-39-38-40-41-42-43-44	5323	2.159
85	1-2-3-5-6-4-7-9-8-10-11-12-14-13-16-15-18-17-19-21-20-22-25-23-24-26-28-27-30-29-31-32-33-34-36-35-38-37-39-40-41-42-43-44	5217	1.664
86	1-2-4-3-5-8-7-6-9-10-12-11-14-13-15-16-17-19-18-20-21-23-22-24-25-26-28-27-29-30-31-33-32-34-35-36-37-39-38-40-41-43-42-44	5195	1.543
87	1-2-3-4-5-7-6-8-10-9-11-12-13-14-16-15-17-18-20-19-21-22-23-24-25-26-27-28-30-31-29-32-34-33-35-37-36-38-39-40-41-42-44-43	5163	1.225
88	2-1-3-4-5-6-7-8-9-10-11-13-12-14-15-16-17-20-18-19-22-21-23-24-25-27-26-28-29-30-31-33-32-34-35-36-37-39-38-40-41-42-44-43	5397	1.224
89	1-2-3-4-5-6-8-9-7-10-11-12-14-15-13-19-16-18-17-20-22-23-21-25-26-24-27-28-29-30-31-32-34-33-35-37-38-36-39-40-41-42-43-44	5309	1.865
90	1-3-4-2-7-5-6-9-8-11-10-12-13-14-15-18-16-19-17-20-21-22-23-24-26-25-28-27-29-30-31-32-34-35-33-36-38-37-39-40-41-43-42-44	5318	1.829
91	1-2-3-4-6-7-5-8-9-11-10-13-12-14-15-17-16-19-18-20-21-22-23-24-26-25-27-28-30-29-31-32-33-34-35-37-38-36-40-39-42-41-44-43	5123	1.645
92	1-4-2-3-5-7-6-8-11-9-10-12-13-16-14-15-17-18-19-21-20-24-23-22-26-25-28-30-27-29-33-31-34-32-35-36-40-37-38-44-39-43-41-42	5222	3.310
93	1-2-5-3-6-4-8-9-7-10-11-13-12-14-15-16-18-17-21-19-20-22-23-24-25-26-28-27-29-30-31-33-32-34-35-36-37-38-39-41-40-42-44-43	5408	1.782
94	1-2-3-4-5-7-6-8-10-11-9-13-12-14-16-15-17-18-20-19-21-22-24-23-25-26-28-27-30-29-31-32-34-33-36-38-37-39-35-40-44-41-43-42	5158	2.516
95	1-3-2-5-4-6-7-9-8-11-10-12-14-13-15-16-19-18-17-20-21-22-23-24-26-25-28-29-27-30-31-35-33-32-34-37-36-38-39-41-40-44-43-42	5064	2.408

96	1-2-3-4-6-5-7-9-8-11-10-13-12-14-15-16-17-18-19-20-21-22-23-24-25-26-27-29-28-30-31-32-33-34-35-37-36-38-39-40-41-42-43-44	5030	0.876
97	2-3-1-5-4-6-7-9-12-8-10-11-15-13-17-14-16-19-18-20-21-22-23-25-24-26-28-27-29-30-31-33-32-34-35-36-37-40-38-39-43-41-44-42	5180	2.421
98	2-1-4-3-7-6-5-9-8-10-11-13-12-15-14-17-16-18-20-19-22-24-21-23-25-26-27-28-29-30-32-33-31-36-34-37-35-38-39-40-41-44-42-43	5228	2.373
99	2-1-4-5-6-3-8-7-10-12-9-11-13-14-15-16-18-17-19-20-23-21-22-24-25-27-26-28-29-30-31-32-33-34-35-36-37-38-39-41-40-43-44-42	5208	1.810
100	1-3-2-4-5-6-7-8-9-10-11-12-13-15-14-19-17-16-18-20-22-21-24-25-23-26-27-30-28-29-31-32-33-34-36-35-38-37-39-41-40-44-43-42	5203	2.040
Terendah		4949	0.655
Tertinggi		5553	3.310
Total		524931	181.738
Rata-Rata		5249.31	1.817

3. Hasil *Makespan* Algoritma *Tabu Search*

Number Of Run	Urutan Penjadwalan	*Makespan* (*time unit*)	*Run Time* (detik)
1	2-4-1-3-5-12-6-8-9-7-10-15-11-13-18-14-17-16-19-21-22-23-25-20-27-24-26-30-28-32-33-29-34-35-36-31-38-40-39-41-44-42-37-43	5138	109.662
2	2-1-5-7-8-3-6-4-9-15-10-11-12-20-14-13-16-18-19-22-17-24-23-21-25-27-26-30-28-29-31-32-33-34-35-36-38-39-41-37-40-42-43-44	5169	109.837
3	1-6-2-3-4-5-8-7-10-9-12-11-13-16-20-14-18-15-19-21-22-17-23-24-27-26-28-31-25-30-32-29-42-34-36-33-38-43-40-41-37-44-35-39	4907	110.173
4	3-2-4-1-7-5-15-6-9-11-13-17-8-14-10-12-18-19-20-23-16-21-24-22-26-25-27-30-28-31-29-32-33-34-35-37-36-39-40-38-42-41-43-44	5286	109.819
5	5-1-2-3-4-9-8-7-11-14-6-12-10-23-18-13-17-22-16-15-19-20-21-26-24-25-28-27-30-29-31-32-33-34-35-36-37-39-38-41-40-42-43-44	5114	109.578
6	5-1-4-3-6-2-9-8-7-11-12-10-13-14-15-20-17-16-18-19-21-24-23-25-22-26-27-29-32-30-33-28-31-34-35-36-37-38-39-41-43-40-44-42	5100	109.999
7	4-2-7-3-6-5-9-1-12-13-8-11-10-16-14-17-15-18-19-20-21-22-23-24-25-27-26-28-31-32-33-29-30-35-36-38-34-37-44-42-39-41-43-40	5092	109.637
8	1-6-2-4-3-5-7-8-9-11-12-10-14-16-13-18-15-17-20-19-21-23-24-22-26-25-27-38-31-30-28-29-34-35-32-37-40-39-36-33-41-42-44-43	5068	110.305
9	2-1-4-3-8-7-6-14-9-10-5-16-11-13-15-12-17-18-19-20-21-23-22-24-25-27-29-28-26-30-31-33-32-35-36-34-39-37-38-40-41-42-43-44	5154	109.372
10	7-2-3-5-6-12-4-1-8-11-9-10-14-13-15-17-16-19-20-18-23-21-22-25-24-28-32-26-31-27-35-33-30-29-36-34-41-38-37-43-39-40-42-44	4950	110.246
11	1-3-6-5-2-4-8-7-9-12-10-13-11-14-17-22-18-15-21-16-19-23-20-24-25-27-26-32-28-29-33-34-30-31-35-36-37-39-40-38-44-41-42-43	5314	109.835
12	3-2-4-14-5-1-6-7-10-8-9-11-13-12-15-20-16-17-22-18-21-19-23-25-24-29-26-27-31-28-30-32-44-33-34-36-40-38-35-42-37-39-41-43	5087	110.108
13	2-1-3-4-6-5-7-8-10-9-12-11-16-14-13-17-18-15-19-22-20-23-21-24-25-27-26-28-30-31-29-32-34-33-36-35-38-37-39-42-40-41-43-44	5137	109.723
14	4-1-3-2-6-5-7-10-8-12-11-9-14-17-15-13-16-18-20-19-21-29-23-22-25-24-33-26-28-27-30-35-34-31-32-36-42-39-37-38-41-44-40-43	5242	110.540
15	3-4-1-2-6-7-5-10-14-11-13-8-12-17-18-15-16-9-20-19-22-21-23-24-30-26-25-27-35-28-38-31-29-34-33-36-32-37-41-40-42-43-39-44	5095	110.548

16	2-1-3-4-5-6-8-7-10-11-17-9-14-12-24-13-19-15-20-18-16-26-21-23-28-22-27-30-35-25-32-29-31-41-36-33-38-34-37-40-44-39-43-42	5211	110.165
17	2-7-1-5-3-6-4-10-9-14-12-8-11-15-17-13-18-19-16-20-27-21-24-31-25-30-26-23-32-29-33-22-28-35-36-34-37-44-39-40-42-38-41-43	5038	110.093
18	3-5-7-4-6-2-1-8-9-11-10-12-17-15-18-14-13-19-16-21-20-23-22-27-24-30-26-25-29-28-34-33-36-32-40-31-38-35-39-42-37-41-44-43	5218	110.036
19	1-2-4-3-6-5-8-7-9-10-13-11-12-15-14-17-19-18-23-22-24-25-21-20-27-26-16-29-28-30-31-34-32-33-37-35-40-36-38-39-41-44-42-43	5216	109.734
20	1-3-5-2-4-6-7-8-9-10-11-13-12-14-17-18-16-15-19-23-27-25-24-20-22-26-21-29-28-31-33-30-35-34-32-42-39-36-40-37-44-43-41-38	5149	110.038
21	1-2-3-6-4-5-7-9-10-8-14-11-13-12-15-17-16-18-19-22-21-20-23-24-25-27-26-28-29-30-31-32-33-40-35-38-34-36-37-41-39-43-42-44	5237	110.109
22	8-7-6-3-4-2-9-5-1-11-10-12-15-13-17-14-16-18-21-19-20-22-23-24-26-25-27-28-29-30-31-32-34-33-35-36-37-38-42-40-39-43-44-41	5186	110.545
23	1-2-3-9-7-4-10-5-12-11-6-8-13-14-15-16-19-23-17-20-21-18-24-22-25-26-29-27-28-30-31-33-32-35-34-36-37-40-38-43-39-41-42-44	5152	110.991
24	6-2-4-5-1-3-10-7-8-9-12-13-14-15-11-16-19-17-23-21-18-22-20-24-25-26-27-28-29-31-30-33-34-36-38-35-32-37-39-44-42-40-43-41	5089	112.779
25	10-2-6-3-5-15-13-7-1-12-4-11-8-9-14-18-16-21-19-17-23-20-22-24-25-32-27-31-28-30-29-33-26-34-36-37-35-38-39-40-41-42-43-44	5003	109.643
26	7-2-3-4-5-9-1-6-11-8-10-12-13-15-14-16-17-18-21-19-20-23-22-26-24-28-25-27-29-30-31-32-34-33-36-37-35-38-41-40-44-42-39-43	5343	113.791
27	1-2-5-3-7-6-4-10-8-9-12-13-14-11-15-16-19-17-20-21-18-22-26-29-27-25-23-24-28-31-34-32-37-30-35-33-36-38-39-41-43-40-42-44	5069	111.115
28	2-4-3-1-5-6-7-9-8-12-11-10-15-13-16-14-18-17-20-24-19-21-22-26-23-27-25-28-29-31-32-30-34-33-37-35-38-36-39-40-41-42-44-43	5174	110.992
29	2-1-3-4-5-6-7-10-8-13-11-9-12-15-14-16-18-17-19-20-21-22-23-26-24-28-27-25-31-32-33-29-36-30-35-34-37-38-39-40-44-43-42-41	5123	110.848
30	3-8-4-2-6-1-5-11-14-10-13-9-7-12-17-15-16-21-18-23-20-19-25-22-24-26-29-28-30-31-27-32-33-34-35-37-36-42-39-43-38-40-41-44	5007	111.105
31	6-4-2-7-10-12-3-8-5-11-18-9-21-17-13-14-1-22-19-20-15-16-23-26-29-25-27-28-24-30-32-31-33-35-37-34-36-38-39-40-44-43-41-42	5074	110.396

32	3-4-8-1-6-2-9-5-7-12-10-11-13-14-16-21-22-17-18-20-15-19-23-24-26-25-27-28-29-31-30-32-35-33-34-36-38-39-37-40-42-41-44-43	5100	110.912
33	1-2-4-3-5-6-7-8-9-10-12-11-13-14-15-16-17-18-19-20-21-22-23-26-24-25-29-27-28-30-31-33-32-35-34-36-37-38-39-40-41-42-43-44	5189	110.303
34	2-1-3-7-5-4-8-14-10-6-11-9-12-13-16-17-19-15-20-24-18-23-21-22-26-29-25-27-30-36-28-37-31-33-32-39-38-34-40-42-41-35-43-44	5115	109.274
35	1-6-5-4-2-3-10-7-12-8-9-11-15-16-19-13-14-21-17-22-18-20-24-23-25-27-26-28-29-31-30-37-33-39-36-32-44-41-38-34-42-43-40-35	4853	111.051
36	6-1-4-2-5-3-9-10-8-12-11-7-13-14-17-15-18-16-19-21-20-23-22-26-24-27-29-25-30-28-34-31-32-35-33-37-36-38-39-40-41-42-44-43	5046	112.006
37	1-5-2-3-6-7-4-8-9-10-11-13-12-14-16-17-15-19-18-20-22-21-23-25-24-26-28-29-27-30-32-35-31-34-33-36-38-37-39-41-40-43-44-42	5149	110.585
38	1-3-4-2-5-6-12-8-7-9-10-11-13-15-17-16-14-18-21-20-19-24-22-23-26-25-27-28-30-29-31-34-33-35-36-32-37-38-40-39-41-43-42-44	5195	110.271
39	4-3-5-2-1-9-7-12-6-8-11-13-10-15-21-17-16-14-18-19-20-24-22-26-25-23-27-28-29-30-32-31-33-35-39-34-36-37-38-40-43-41-44-42	4995	115.139
40	1-2-3-4-5-6-7-8-9-10-11-13-12-14-15-17-16-19-18-20-21-22-23-25-24-26-28-27-29-30-31-32-34-33-35-36-38-37-40-39-41-43-42-44	5203	110.107
41	1-2-3-6-5-4-8-7-9-11-14-10-12-13-15-19-16-17-18-20-21-22-24-23-25-26-27-29-28-30-31-32-33-34-36-35-37-38-39-44-41-42-40-43	5086	110.858
42	3-4-2-5-1-6-10-7-14-8-9-12-13-16-17-15-11-18-20-23-24-27-19-21-25-22-29-26-33-28-32-31-30-36-34-35-38-40-37-39-41-42-44-43	5143	110.901
43	2-6-3-7-4-5-10-1-8-9-11-13-12-14-17-16-15-18-19-20-21-22-23-24-25-26-28-27-29-30-31-35-32-36-34-39-33-37-38-40-41-42-43-44	5137	111.188
44	1-2-5-3-4-8-6-7-11-9-10-13-12-16-14-18-19-21-17-15-22-20-23-24-27-25-26-28-32-29-30-31-36-34-33-37-35-42-38-40-39-41-44-43	4999	110.482
45	2-1-5-6-8-7-4-3-11-12-10-9-13-14-15-17-18-19-23-21-16-20-24-22-25-26-28-27-29-30-31-36-32-33-37-34-40-38-39-35-41-43-44-42	4906	109.719
46	1-4-3-2-5-6-8-7-11-10-9-12-16-21-13-14-17-15-20-22-19-18-23-26-27-24-31-25-29-28-32-41-30-36-42-33-37-38-35-44-39-40-43-34	5076	111.524
47	8-5-1-3-4-2-7-10-6-11-9-12-14-13-15-18-17-20-16-19-21-29-22-24-23-25-28-26-32-30-31-27-33-34-35-37-40-38-42-36-39-41-43-44	5019	110.599

48	3-6-5-7-1-2-4-8-10-9-11-12-13-15-14-16-17-18-21-22-19-23-24-27-29-25-20-26-28-34-31-30-32-37-33-36-38-35-41-44-39-43-40-42	5277	111.234
49	1-3-2-4-5-6-7-8-11-9-10-14-13-12-16-18-22-17-15-19-21-20-29-32-31-24-23-27-25-26-30-28-33-34-36-35-37-38-39-40-41-42-44-43	5191	114.216
50	2-1-5-4-8-3-7-9-13-6-10-11-16-12-14-15-17-18-20-21-19-23-22-25-26-24-27-28-30-31-29-32-33-35-36-34-38-37-40-41-39-44-43-42	4908	110.140
51	2-10-1-4-5-9-3-6-7-8-12-11-14-13-15-16-17-18-19-22-20-21-23-24-27-25-29-26-28-30-34-32-33-37-31-35-36-40-38-39-42-41-44-43	5019	110.172
52	1-4-3-2-6-9-5-7-8-10-11-12-15-14-13-17-18-16-20-19-22-21-23-25-24-26-27-28-30-29-31-33-32-35-36-37-34-38-39-40-44-41-43-42	5211	109.744
53	1-8-3-9-2-6-4-7-10-5-11-12-15-13-16-17-14-18-20-19-23-22-25-24-21-26-27-28-30-29-32-31-35-33-34-37-39-38-36-43-41-40-42-44	5130	110.630
54	2-1-3-7-5-6-4-10-9-8-13-12-11-14-24-15-17-20-18-16-22-25-21-26-23-19-28-29-27-30-32-31-37-33-34-40-35-36-39-41-43-44-42-38	5159	112.886
55	1-2-4-3-5-7-6-11-8-9-12-10-14-13-15-17-16-21-18-20-19-24-27-23-25-26-30-28-22-31-29-32-33-35-34-36-38-37-39-40-42-44-41-43	5047	110.307
56	3-4-1-5-8-6-2-10-7-9-11-14-13-15-12-16-17-19-18-20-24-22-21-25-26-23-27-28-29-30-35-32-34-31-33-41-36-37-38-39-44-40-42-43	5199	110.552
57	5-2-6-4-1-3-9-7-12-8-10-11-13-14-15-17-18-16-19-21-22-20-24-23-25-28-26-29-27-30-31-33-32-34-36-35-37-38-39-40-42-41-43-44	5298	112.199
58	3-4-6-2-1-7-5-10-8-9-11-12-14-15-13-16-17-18-19-20-22-21-23-24-25-26-28-27-30-29-31-32-34-33-36-35-37-38-40-39-41-43-42-44	5414	111.119
59	3-5-1-6-4-10-2-8-9-7-14-12-11-19-15-22-13-16-17-18-21-24-25-20-23-27-29-26-28-32-31-30-37-33-35-34-43-36-39-44-40-42-41-38	5171	112.402
60	2-3-1-6-4-5-8-7-10-11-13-9-12-14-15-17-18-19-22-16-25-23-24-21-26-20-30-28-27-29-36-32-34-31-37-35-33-39-38-40-41-44-43-42	5158	109.931
61	4-9-2-1-3-5-6-7-8-11-12-10-13-16-14-17-15-20-18-21-19-24-22-23-25-26-27-29-28-30-31-32-33-34-35-36-37-40-38-39-42-41-43-44	5167	110.188
62	4-5-2-3-8-1-6-11-9-7-10-12-13-15-14-19-16-18-17-21-20-22-25-24-27-29-26-23-31-28-30-32-33-34-37-35-39-36-38-40-42-43-41-44	5369	112.917
63	4-5-1-7-3-6-2-8-9-11-12-14-10-15-16-18-13-17-20-19-22-23-21-25-24-27-26-28-29-30-31-34-33-32-35-37-38-40-36-44-42-39-41-43	5221	111.791

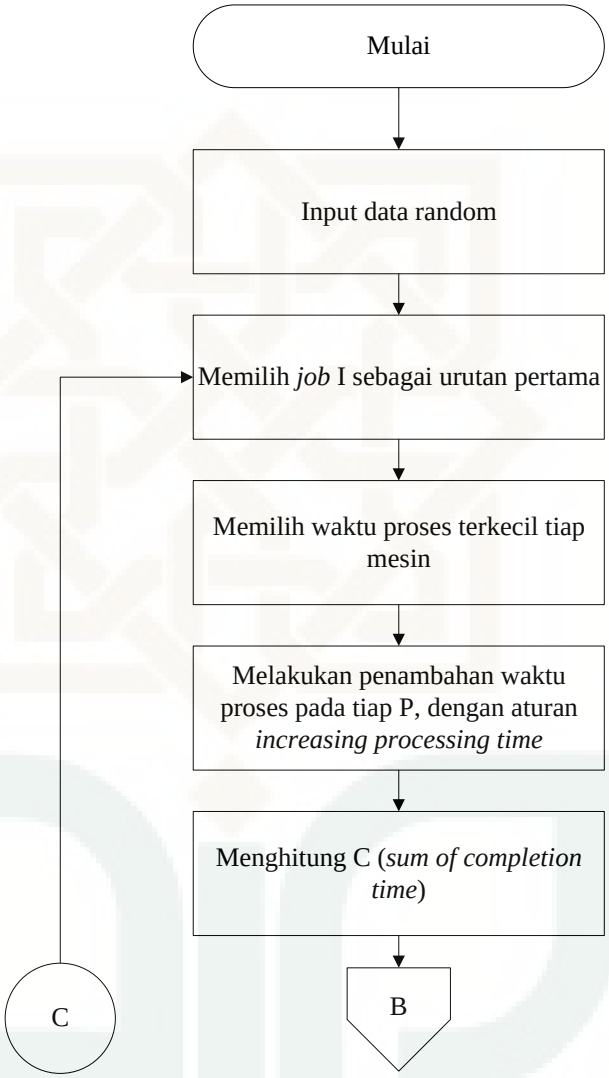
64	1-3-2-4-6-7-5-8-9-11-12-13-10-24-14-16-17-15-19-18-22-21-23-25-27-20-26-30-28-33-29-31-32-34-37-35-38-36-40-42-44-39-43-41	5106	121.107
65	2-4-6-1-9-7-3-5-8-11-13-10-12-14-15-16-18-17-21-19-20-22-24-23-25-26-27-29-28-32-30-31-33-35-34-36-37-40-39-42-38-41-44-43	5206	111.626
66	1-3-4-2-8-6-5-9-7-12-14-11-10-15-13-16-20-17-19-21-18-23-22-25-24-27-29-28-26-30-31-32-36-33-34-37-35-38-39-40-41-42-44-43	5058	111.921
67	4-2-1-7-3-8-5-9-10-6-11-12-14-15-13-18-16-17-20-21-19-22-23-24-25-26-28-27-29-30-31-33-34-32-35-36-37-38-40-43-39-41-42-44	5352	114.457
68	2-3-9-1-4-5-14-17-8-6-7-16-12-10-15-11-13-21-23-18-20-24-19-25-22-26-27-28-30-29-31-33-36-32-35-34-39-38-37-41-40-42-43-44	5253	110.857
69	2-4-1-3-5-9-7-10-11-6-12-13-8-18-14-17-16-15-20-22-21-19-23-24-25-29-28-26-27-36-30-35-33-31-37-34-40-32-39-42-41-43-38-44	4979	110.850
70	1-2-3-5-4-6-7-8-9-11-10-12-14-16-13-18-15-20-17-19-21-24-22-23-30-26-25-28-27-31-37-33-29-36-40-34-32-44-41-35-38-42-39-43	5231	113.850
71	1-2-3-4-5-7-6-8-9-10-11-12-16-13-14-17-15-18-20-22-21-24-19-26-25-23-27-30-28-29-31-34-32-36-33-35-39-38-40-42-41-37-43-44	5298	110.505
72	3-1-2-4-5-7-8-6-9-10-13-11-12-15-14-18-17-16-19-20-22-21-24-26-23-25-32-30-27-28-29-33-31-36-37-34-39-38-41-35-43-42-40-44	5177	112.043
73	2-1-3-8-5-4-6-10-7-9-11-12-15-14-13-18-16-17-22-19-20-21-23-26-24-25-27-29-28-30-32-31-33-34-36-35-38-37-39-40-41-43-42-44	5189	110.212
74	2-3-1-4-5-7-8-6-9-11-12-10-13-14-15-16-18-17-20-19-21-22-24-23-25-26-27-28-30-29-31-32-33-34-35-36-38-37-40-39-41-43-42-44	5263	109.740
75	3-1-4-5-11-6-2-10-7-9-12-14-18-8-16-13-15-21-17-20-22-19-23-25-26-27-24-30-28-29-32-33-31-34-35-36-37-39-38-40-41-43-44-42	5181	109.284
76	5-1-4-7-3-8-2-10-11-6-9-14-12-15-16-13-18-17-20-19-22-21-24-23-26-27-25-29-28-31-30-33-32-36-34-35-37-38-41-40-39-42-43-44	5194	110.559
77	4-3-1-2-7-5-6-8-9-10-11-12-14-13-15-16-17-18-20-19-23-21-25-22-27-24-30-29-26-32-31-28-34-33-35-36-39-37-38-40-41-43-42-44	5245	110.303
78	1-2-3-5-4-6-7-9-8-10-11-13-12-14-15-16-17-18-19-21-20-23-22-24-25-26-27-28-29-30-31-32-33-34-35-36-37-39-40-38-41-42-43-44	5457	115.167
79	1-3-2-5-4-6-8-9-7-11-10-12-13-15-17-19-25-14-16-21-23-20-18-24-26-28-27-22-30-29-34-31-33-37-32-36-38-35-42-40-41-44-43-39	5018	110.965

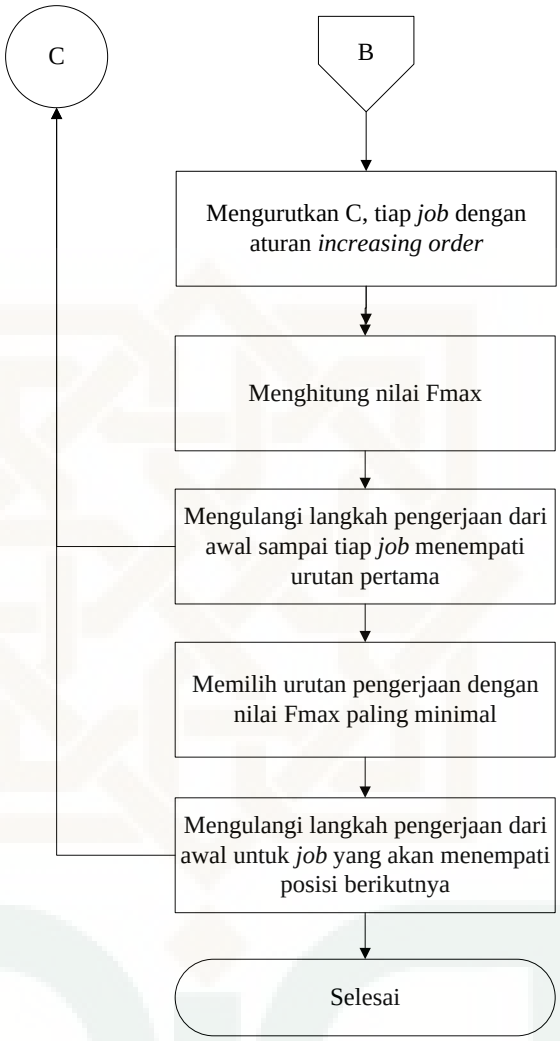
80	1-2-5-6-3-7-9-8-4-11-10-14-12-13-15-16-17-18-20-19-22-24-21-23-25-26-28-27-29-30-31-33-34-35-32-36-37-39-38-40-41-42-44-43	5020	111.784
81	2-3-1-4-6-13-5-10-8-17-7-9-11-15-12-14-16-18-19-20-33-21-22-23-26-27-25-29-24-31-28-32-30-37-36-34-40-35-39-41-42-44-38-43	4914	114.107
82	5-2-6-3-1-7-8-11-10-4-9-12-13-14-16-17-15-19-20-18-21-22-23-25-26-27-24-28-31-30-29-34-32-35-37-33-40-39-38-36-42-43-44-41	5337	115.055
83	3-5-4-1-9-2-6-7-10-8-14-11-12-13-15-16-17-18-19-22-20-25-23-26-27-21-28-24-30-29-32-31-33-34-35-37-39-36-40-38-41-42-44-43	5081	118.630
84	5-1-7-2-9-4-3-10-8-11-12-6-15-13-14-17-16-19-18-22-20-24-21-23-25-27-30-26-28-29-33-31-35-34-37-36-32-39-38-40-41-42-43-44	5190	110.970
85	1-5-3-2-4-7-9-10-8-12-29-6-14-13-11-18-17-22-21-16-15-19-25-23-20-24-28-26-36-38-33-31-27-30-34-35-37-40-39-41-42-43-44-32	5027	111.295
86	8-1-5-3-2-6-13-20-10-4-14-9-7-18-19-12-11-17-22-16-15-24-21-23-25-26-33-28-27-34-29-30-31-32-37-35-36-39-38-40-41-43-42-44	4896	111.055
87	1-4-3-2-7-6-8-12-10-11-5-16-13-9-17-14-18-20-19-15-21-22-24-26-25-23-28-27-30-31-32-29-34-33-35-37-36-38-39-40-41-42-44-43	5021	123.941
88	4-2-3-6-7-11-1-9-12-10-5-14-13-8-15-16-20-17-19-27-22-21-23-28-18-26-25-30-29-31-34-33-24-35-36-32-37-39-44-38-40-41-43-42	5100	113.651
89	1-2-3-4-5-6-8-9-10-11-7-12-14-15-19-13-16-18-17-20-22-23-25-21-26-24-27-28-29-30-32-31-34-33-35-37-38-36-39-40-41-42-43-44	5289	121.612
90	7-1-3-4-5-6-9-2-13-10-8-11-12-14-21-18-15-19-16-20-22-17-23-24-26-31-25-27-29-28-30-32-34-35-33-36-38-41-43-40-37-42-44-39	5082	134.452
91	1-2-3-6-4-7-8-9-11-5-13-10-14-12-15-17-18-19-16-20-21-24-22-23-27-26-28-25-30-29-31-32-33-34-35-38-37-36-40-44-39-42-41-43	5076	118.483
92	4-1-2-3-5-7-6-8-11-9-10-17-12-13-16-14-15-18-19-21-20-24-26-23-22-25-30-28-29-27-33-34-31-35-32-36-37-40-43-38-44-39-41-42	5178	116.223
93	6-2-4-5-3-8-1-9-7-10-11-12-13-14-16-15-18-21-17-22-19-20-24-25-26-23-29-27-30-28-31-38-33-32-34-39-35-36-41-37-40-42-44-43	5216	115.088
94	1-2-3-4-5-7-6-8-11-13-10-9-14-15-18-16-12-17-20-19-21-22-24-25-23-28-26-27-30-29-31-32-34-33-36-38-37-39-35-40-44-41-43-42	5137	115.070
95	3-1-2-5-4-6-7-9-8-11-10-14-13-12-15-16-19-18-17-21-20-24-26-22-23-25-28-29-27-30-31-35-34-33-37-32-36-38-39-41-40-44-43-42	5050	115.697

96	1-2-3-4-6-5-7-11-9-8-13-10-12-14-15-16-17-23-18-19-20-25-24-21-26-22-29-30-27-28-31-33-34-32-35-37-38-36-40-43-41-39-42-44	4937	111.097
97	2-3-1-5-4-7-6-9-12-8-10-15-11-13-17-14-16-19-18-20-21-22-23-25-24-26-28-27-29-30-31-33-32-35-34-37-40-38-43-36-39-41-44-42	5152	109.777
98	2-4-1-7-9-3-6-10-5-8-11-13-15-12-14-17-20-16-18-19-24-22-21-23-26-25-27-28-29-30-32-33-31-36-37-34-35-38-39-42-41-40-44-43	5157	108.849
99	2-1-4-6-3-5-8-12-7-9-11-10-14-13-15-16-18-19-17-20-23-21-22-24-25-27-26-30-28-31-29-34-32-33-35-36-37-38-39-41-40-43-44-42	5162	109.622
100	1-3-2-7-5-6-8-4-9-12-10-15-13-11-19-14-16-20-18-17-25-24-22-21-23-30-31-26-32-29-33-27-36-28-37-34-38-39-41-35-44-43-42-40	5023	111.872
Terendah		4853	108.849
Tertinggi		5457	134.452
Total		513544	11188.883
Rata-Rata		5135.44	111.889

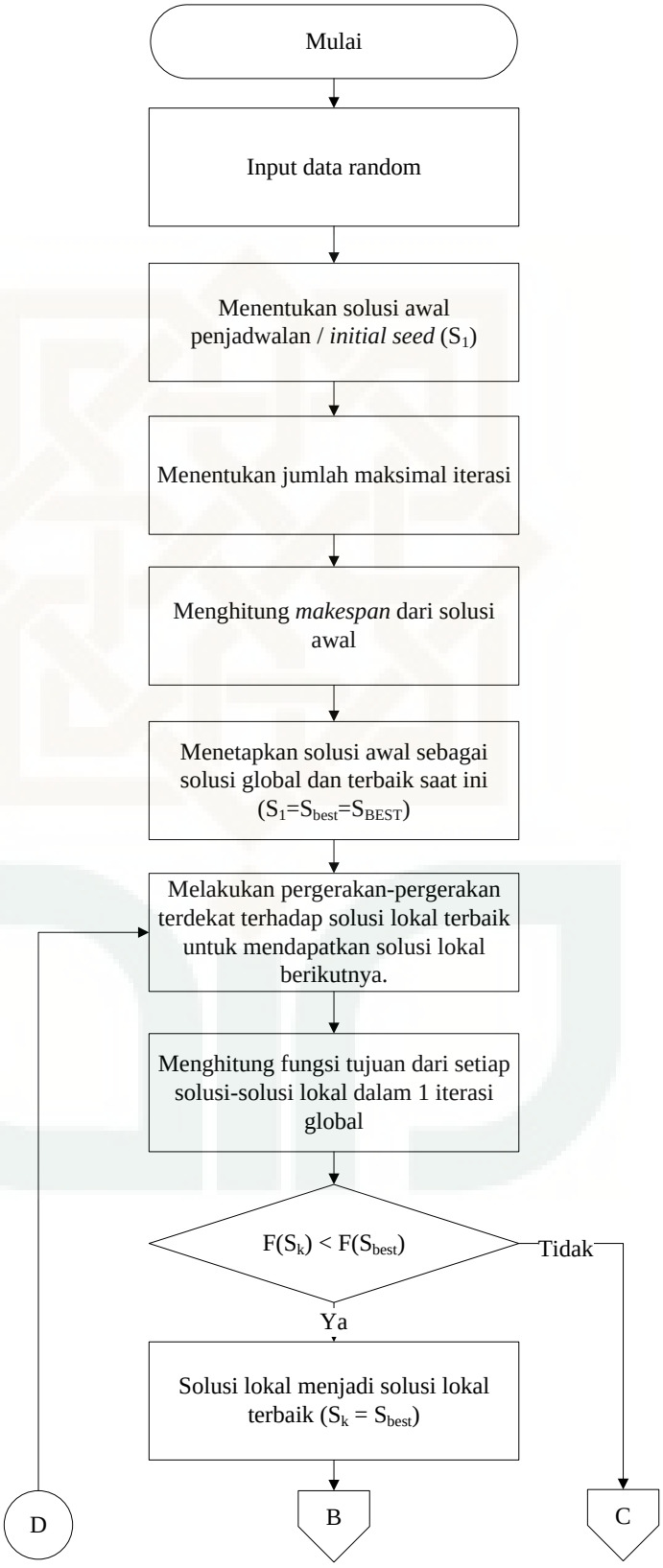
Lampiran 6. *Flow Chart* Metode Heuristik

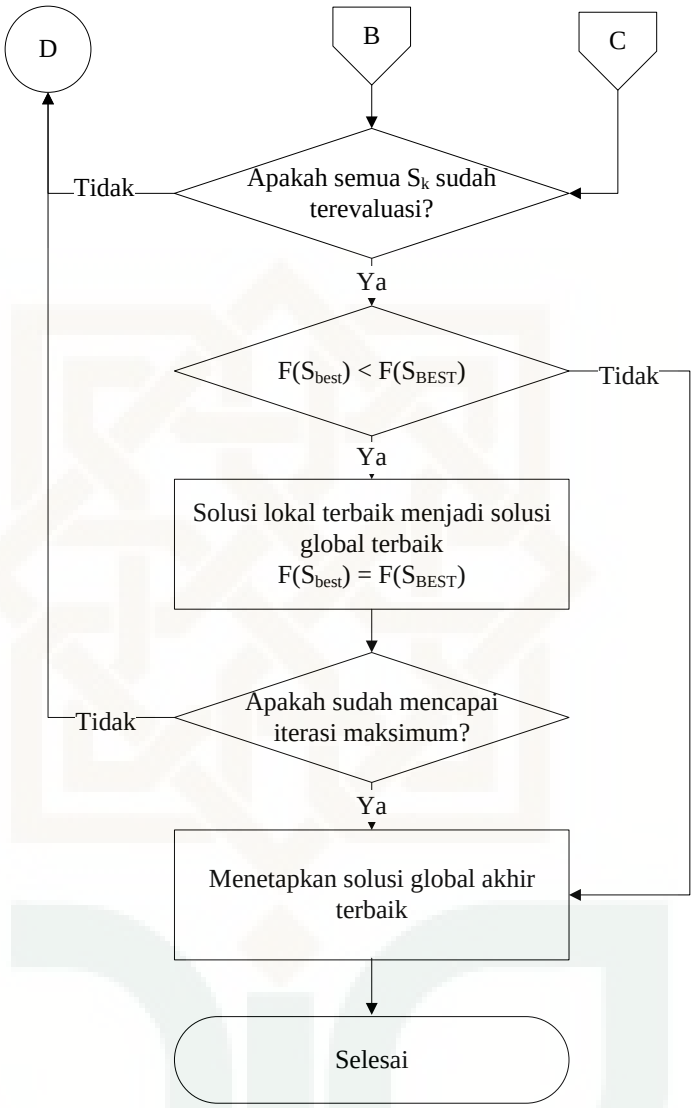
1. *Flow Chart* Metode Heuristik Algoritma *Pour*



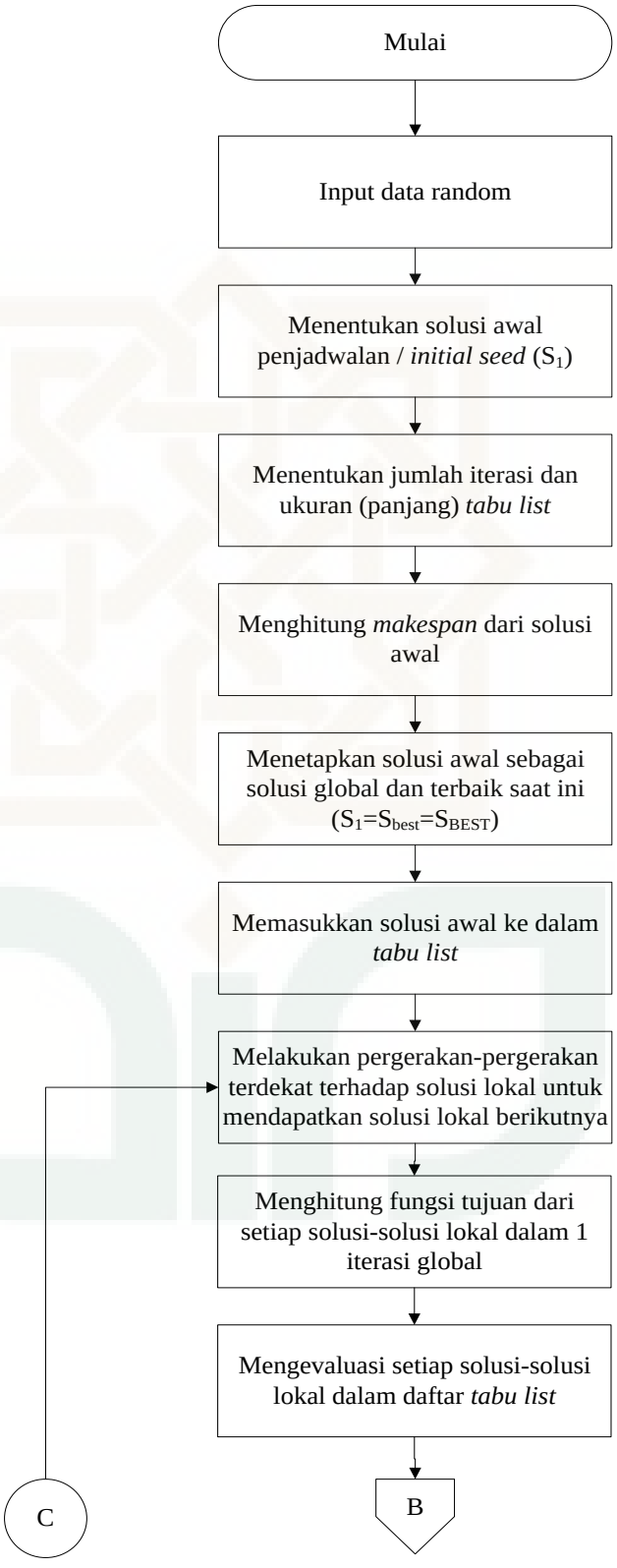

C
B
Mengurutkan C, tiap *job* dengan aturan *increasing order*
Menghitung nilai Fmax
Mengulangi langkah pengerjaan dari awal sampai tiap *job* menempati urutan pertama
Memilih urutan pengerjaan dengan nilai Fmax paling minimal
Mengulangi langkah pengerjaan dari awal untuk *job* yang akan menempati posisi berikutnya
Selesai

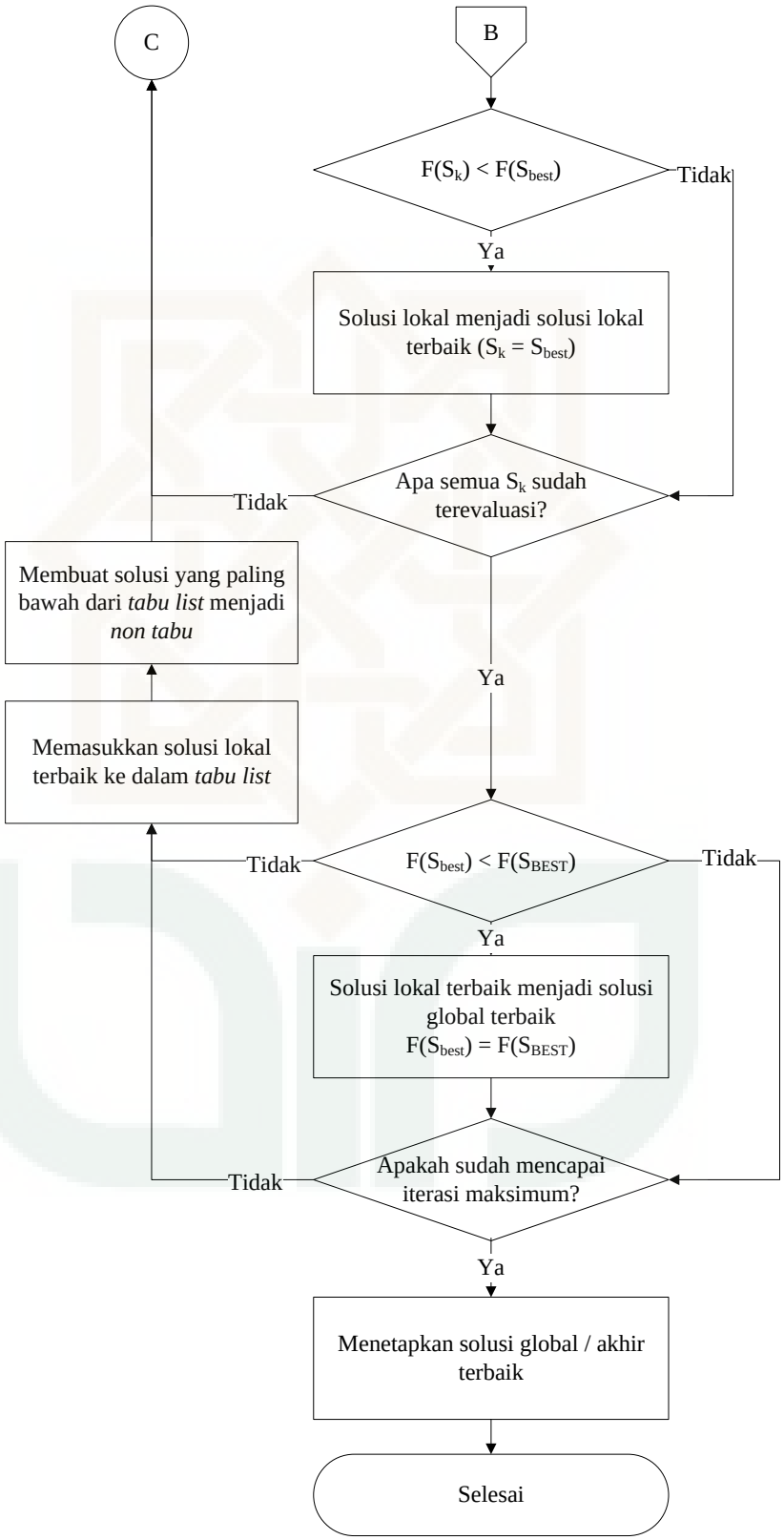
2. *Flow Chart* Metode Heuristik Algoritma NST




D
B
C
Apakah semua S_k sudah terevaluasi?
Tidak
Ya
$F(S_{best}) < F(S_{BEST})$
Tidak
Ya
Solusi lokal terbaik menjadi solusi global terbaik
$F(S_{best}) = F(S_{BEST})$
Apakah sudah mencapai iterasi maksimum?
Tidak
Ya
Menetapkan solusi global akhir terbaik
Selesai

3. *Flow Chart* Metode Heuristik Algoritma *Tabu Search*




C
B
$F(S_k) < F(S_{best})$
Tidak
Ya
Solusi lokal menjadi solusi lokal terbaik ($S_k = S_{best}$)
Apa semua S_k sudah terevaluasi?
Tidak
Membuat solusi yang paling bawah dari *tabu list* menjadi *non tabu*
Ya
Memasukkan solusi lokal terbaik ke dalam *tabu list*
$F(S_{best}) < F(S_{BEST})$
Tidak
Tidak
Ya
Solusi lokal terbaik menjadi solusi global terbaik
$F(S_{best}) = F(S_{BEST})$
Apakah sudah mencapai iterasi maksimum?
Tidak
Ya
Menetapkan solusi global / akhir terbaik
Selesai