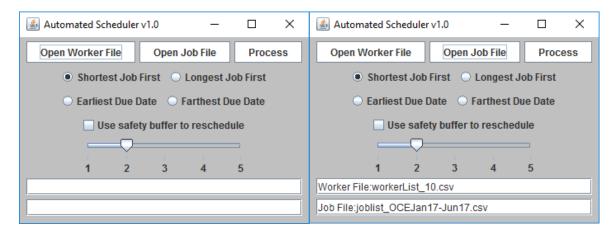
Automated Scheduler

Most of the features requested have been implemented along with additional functionality.

Redesigned interface



The interface now takes an available worker file and a job list. Additional algorithms have been added for comparison, but as noted before, shortest job first almost always minimizes turnaround time and waiting time.

In the event that a job is late, there is an option to auto reschedule the problem job. Select **Use safety buffer to reschedule** and select the safety buffer required. 2 means when there is exactly twice the job time remaining before the due date the scheduler will force the job to the front. **This reschedule comes at the cost of increasing turnaround time and waiting time.**

Ex. Job A takes 10 hours to complete. A safety factor of 2 will force the job to the front when there is 20 hours left before the due date. Safety of 5 will force the job to the front when there is 50 hours left before the due date.

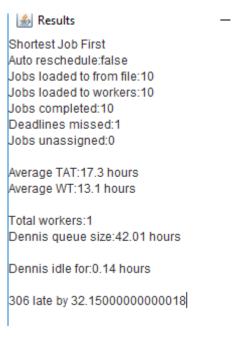
The re-scheduler does not always work, and can make things worse, if there is simply not enough labour capacity.

Ex. A single worker has a queue of items. One labour intensive item is due nearly immediately.

1	А	В	С	D	Е	F	G	Н
1	JobName	Arrival I III	Due nine	JobLength	Priority(0-	Kitted	JobRank	
2	3 6	0	10	8.04	1	TRUE	1	
3	6847		73	3.45	1	TRUE	1	
4	4633	0	75	1.06	1	TRUE	1	
5	5234	0	75	3.85	1	TRUE	1	
5	5234	0	75	3.85	1	TRUE	1	

Note job 306 only has a two hour buffer and since it is labour intensive Shortest Job First, pushes the job to the end of the build order.

Job 306 ends up being late by 32.15 hours.



Applying the reschedule option with a safety factor of 2 pushes the job when necessary and reorders the build. Note the increased turnaround time and waiting time. 17.3->21.15 hours, about 20%, is not insignificant.



Production plan scheduling

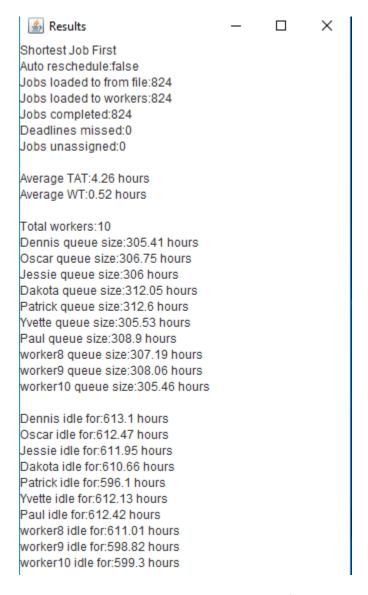
10 workers and 6 months of OCE are processed through the scheduler using Shorted Job First, automatic rescheduling off.

				Α	В	С	D	Е	F	G
			1	JobName	ArrivalTim	DueTime(JobLength	Priority(0-	Kitted	JobRank
			2	306	0	75	8.04	1	TRUE	1
			3	6847	0	75	3.45	1	TRUE	1
			4	4633	0	75	1.06	1	TRUE	1
			5	5234	0	75	3.85	1	TRUE	1
			6	8135	7.5	82.5	4.41	1	TRUE	1
			7	9566	7.5	82.5	5.21	1	TRUE	1
			8	307	7.5	82.5	2.29	1	TRUE	1
			9	8147	7.5	82.5	7.75	1	TRUE	1
- 4	Α	В	10	901	7.5	82.5	3.31	1	TRUE	1
1	Workers	Rank	11	2512	7.5	82.5	2.64	1	TRUE	1
			12	1199	7.5	82.5	2.83	1		1
2	Dennis	1	13	8506	7.5	82.5	4.56	1	TRUE	1
3	Oscar	1	14	908	7.5	82.5	3.05	1		1
4	Jessie	1	15	8146	15	90	5.41	1	TRUE	1
5	Dakota	1	16	468	15	90	4.33	1	TRUE	1
6	Patrick		17	783	15	90	2.84	1	TRUE	1
		1	18	182	15	90	0.53	1	TRUE	1
7	Yvette	1	19	950	22.5	97.5	2.73	1	TRUE	1
8	Paul	1	20	782	30	105	1.61	1	TRUE	1
9	worker8	1	21	926	30	105	3.1	1	TRUE	1
10	worker9	1	22	157	30	105	10.88	1	TRUE	1
			23	9938	37.5	112.5	2.32	1	TRUE	1
11	worker10	1	24	5113	37.5	112.5	2.15	1	TRUE	1

NOTE – Job ranking not displayed but is fully functional. Worker ranks and job ranks may be assigned and the scheduler will only provide jobs as appropriate. See example below.

4	А	В	
1	Workers	Rank	
2	Dennis	2	
3	Oscar	3	
4	Jessie	1	
5	Dakota	0	
6			

Results of 10 employees on OCE



The results pane now includes details on the following

Algorithm Selected - SJF in this case

AutoReschedule - True or false

Jobs loaded from file – How many jobs are read from job list and queued up

Jobs loaded to workers – How many jobs were assign, if no worker is capable, a job will not be assigned and the total will be less than Jobs loaded from file

Jobs completed – Jobs were successfully completed by the workers

Deadlines missed – How many jobs missed on time delivery. The results pane will display the job specifics

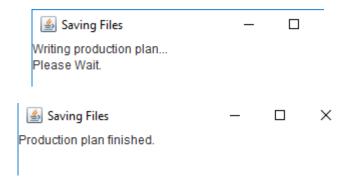
Jobs Unassigned – how many jobs were the workers incapable of processing (Job rank greater than all worker ranks).

Turn around time and waiting time – Averages for both values

Worker queue sizes – How many hours each worker has loaded

Worker Idle time – How many hours the worker has no work. Large idle times may indicate too many workers assigned, though sporadic nature of job arrival will include some idle time. Trace amounts, 0.15 hours, is due to job switching and should be considered fully loaded. (See Dennis idle time for the reschedule example on page 2).

After **Process** is selected the scheduler will sort and produce output files, the output file production may take upwards of 15 seconds, especially on large job plans.

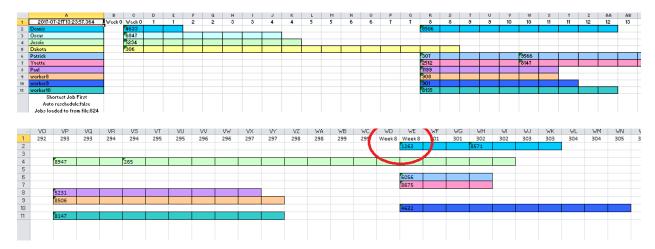


Output Files

The scheduler produces a load list as before, suitable for direct display to employees

2 Oscar 6847 950 5113 8368 5567 4494 7656 7200 8929 6772 4633 950 8 3 Jessie 5234 782 157 8675 8661 5227 311 466 5116 7445 8135 5227 3 4 Dakota 306 8364 5858 6774 8516 9015 7971 783 1263 8147 926 9566 9 5 Patrick 307 9566 5233 8947 2850 2111 6282 9710 8146 8571 7445 5226 6 6 Yvette 2512 8147 9801 2310 8571 8669 7201 3568 8506 4637 5115 2310 7 Paul 1199 182 8146 5851 8671 5244 8678 5228 6771 214 9948 313 4 8 worker8 908 783 9260 6767 4053 8146 3176 6847 852 1199 8147 5114 9 worker9 901 468 8366 4288 5114 8349 2397 5231 9119 6234 1200 307 7 10 worker10 8135 926 6792 7773 56 9016 219 5226 7447 7452 7753 6532 11 12 Shortest Job First 13 Auto reschedule:false 14 Jobs loaded to workers:824 15 Jobs loaded to workers:824 16 Jobs completed:824 17 Deadlines missed:0 18 Jobs unassigned:0	- 4	A	В	С	D	E	F	G	Н		J	K	L	M	N
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The scheduler also now produces a production plan, up to 52 weeks, as a time descriptive Gantt.



With a similar layout to the load list, the cells are broken into ½ hour units, for technical reasons. Each job is represented by a coloured band; size and position estimating start and finish time. The creation time of the production plan is displayed in cell (A,1) with bi-weekly marker, see week 8 red circle. Blank cells represent idle time.

Note – Jobs are rounded UP to the next ½ hour. The cells can be set to 1 hour, but small jobs may become lost in the display, (ex. trying to display two 20min jobs in the same cell). They ARE still on the load list, but overwrite each other on the production plan; 30 minute cells is a reasonable solution.

Additional Notes - Further ideas

The output files, load list and production plan, are regular excel files. They may be edited as desired and saved WITHOUT harm to the scheduler.

Feeding the scheduler garbage does not harm it or previous output files. The scheduler will not function. If the scheduler appears not to function, restart it and double check the correct files are selected and the input files are formatted correctly.

Only one schedule can be produced at a time. The scheduler must be closed and reopened. The scheduler will complain if a previous load list or production plan with the same name is open in excel. It is trying to write to the same file.

Completed jobs could be manually flagged a different colour, or eliminated by running the scheduler again with the job removed from the build list.

Non-kitted jobs could be scheduled and flagged a specific colour.

The production plan is not a history, it is a plan. We already have an actual history, travellers->ISO metrics. Merging these items or production of some other form of record needs discussion.