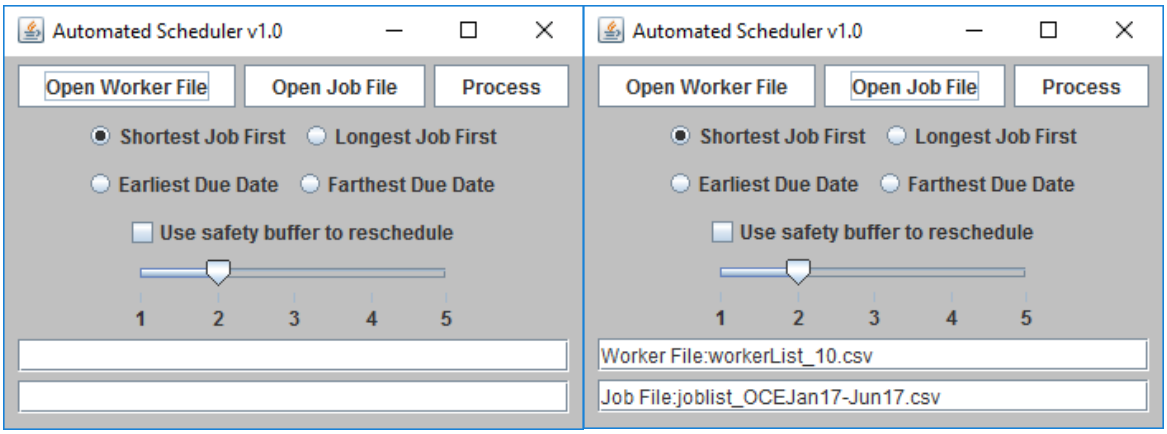
Automated Scheduler

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.

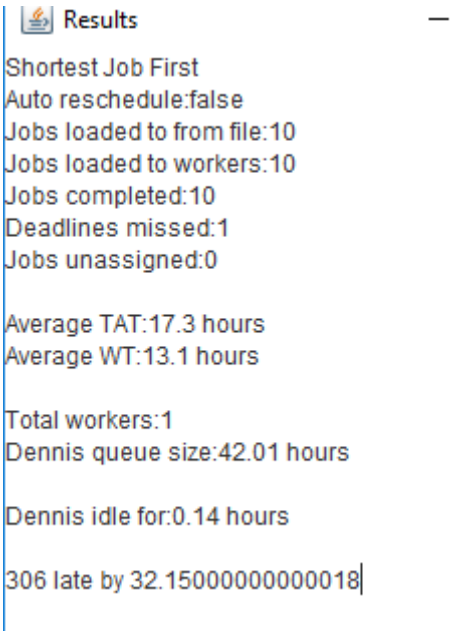
The re-scheduler does not always work, and can make things worse, if there is simply not enough labour capacity.

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

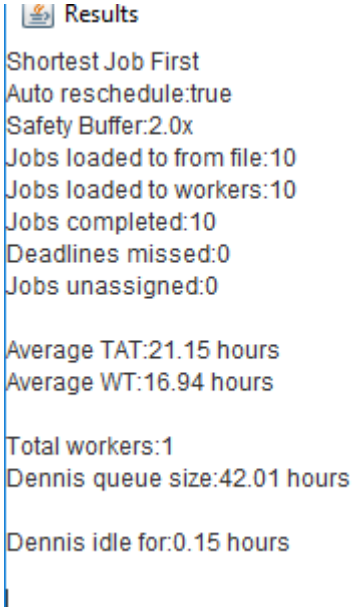
	A	B	C	D	E	F	G	H
1	JobName	Arrival(H	Due Time(	JobLength	Priority(0-	Kitted	JobRank	
2	306	0	10	8.04	1	TRUE	1	
3	6847	0	75	3.45	1	TRUE	1	
4	4633	0	75	1.06	1	TRUE	1	
5	5234	0	75	3.85	1	TRUE	1	

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.

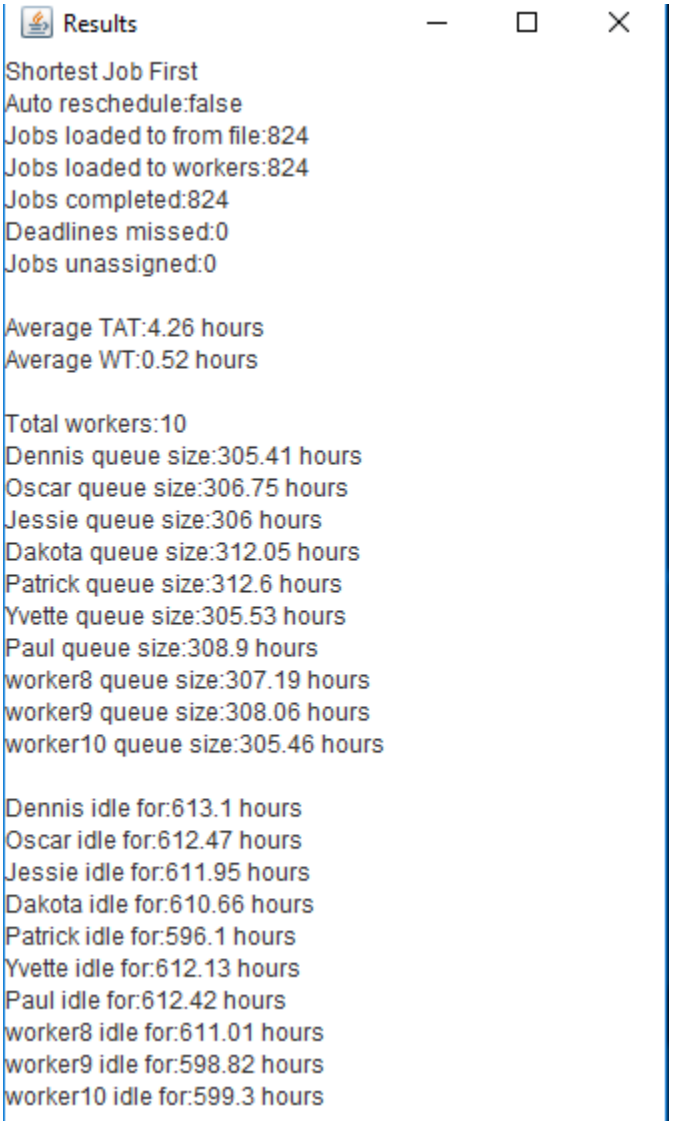
	A	B
1	Workers	Rank
2	Dennis	1
3	Oscar	1
4	Jessie	1
5	Dakota	1
6	Patrick	1
7	Yvette	1
8	Paul	1
9	worker8	1
10	worker9	1
11	worker10	1

	A	B	C	D	E	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
10	901	7.5	82.5	3.31	1	TRUE	1
11	2512	7.5	82.5	2.64	1	TRUE	1
12	1199	7.5	82.5	2.83	1	TRUE	1
13	8506	7.5	82.5	4.56	1	TRUE	1
14	908	7.5	82.5	3.05	1	TRUE	1
15	8146	15	90	5.41	1	TRUE	1
16	468	15	90	4.33	1	TRUE	1
17	783	15	90	2.84	1	TRUE	1
18	182	15	90	0.53	1	TRUE	1
19	950	22.5	97.5	2.73	1	TRUE	1
20	782	30	105	1.61	1	TRUE	1
21	926	30	105	3.1	1	TRUE	1
22	157	30	105	10.88	1	TRUE	1
23	9938	37.5	112.5	2.32	1	TRUE	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.

	A	B
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

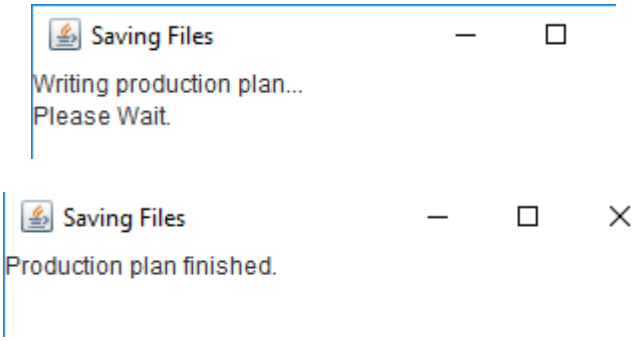
Jobs Unassigned – how many jobs were the workers incapable of processing (Job rank greater than all worker ranks).

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.

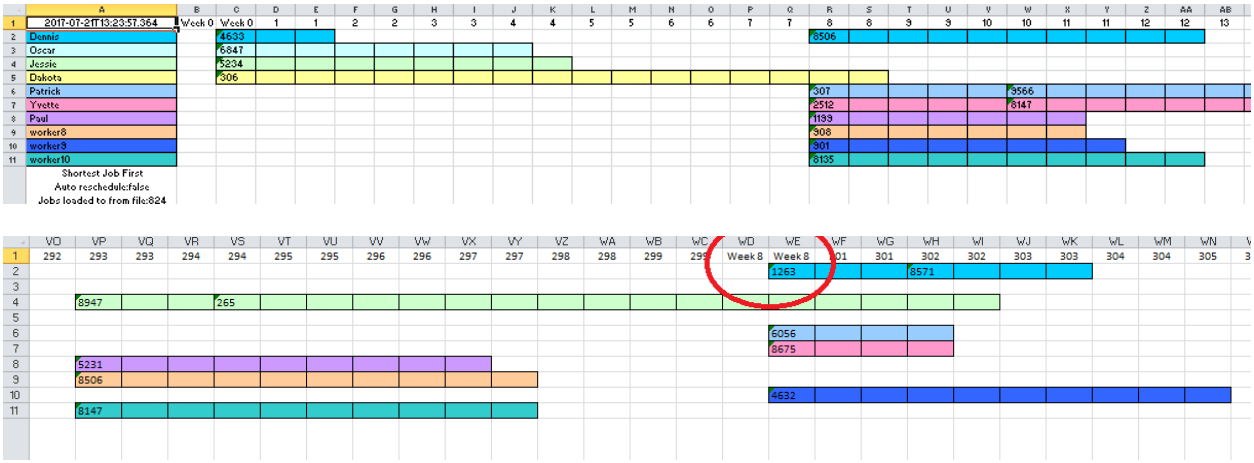


Output Files

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

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Dennis	4633	8506	1263	9938	6321	4143	7969	5230	9260	8515	9275	5567	6
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	1
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	2
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	7
11														
12	Shortest Job First													
13	Auto reschedule:false													
14	Jobs loaded to from file:824													
15	Jobs loaded to workers:824													
16	Jobs completed:824													
17	Deadlines missed:0													
18	Jobs unassigned:0													
19														
20	Average TAT:4.26 hours													
21	Average WT:0.52 hours													
22														
23	Total workers:10													
24	Dennis queue size:305.41 hours													
25	Oscar queue size:306.75 hours													
26	Jessie queue size:306 hours													
27	Dakota queue size:312.05 hours													
28	Patrick queue size:312.6 hours													
29	Yvette queue size:305.53 hours													
30	Paul queue size:308.9 hours													
31	worker8 queue size:307.19 hours													
32	worker9 queue size:308.06 hours													
33	worker10 queue size:305.46 hours													
34														
35	Dennis idle for:613.1 hours													
36	Oscar idle for:612.47 hours													
37	Jessie idle for:611.95 hours													
38	Dakota idle for:610.66 hours													
39	Patrick idle for:596.1 hours													
40	Yvette idle for:612.13 hours													
41	Paul idle for:612.42 hours													

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.