COMP307

Assignment 4

Planning and Scheduling

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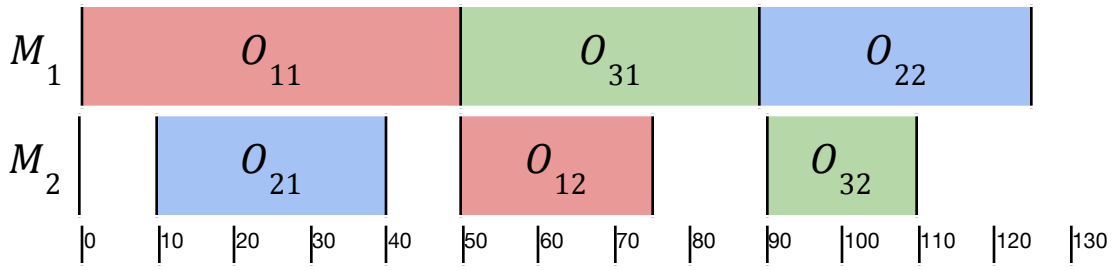
Part 1:

1. As $t_1 \leq t_3$ and only one process can run on M_1 at a time, $Process(O_{11}, M_1, t_1)$ must come before $Process(O_{31}, M_1, t_3)$.



This ordering follows as the only solution such that $t_1 \leq t_2 \leq t_3 \leq t_4 \leq t_5 \leq t_6$

In this situation; $t_1 = 0$; $t_2 = 10$; $t_3 = 50$; $t_4 = 50$; $t_5 = 90$; and $t_6 = 90$.

2. Completion times:

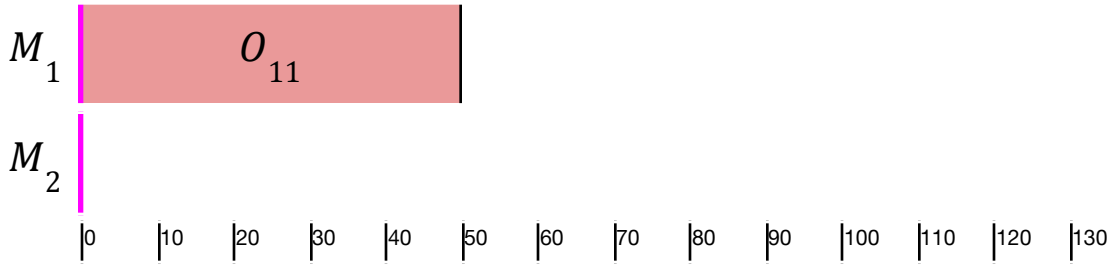
$J_1 = 075$

$J_2 = 125$

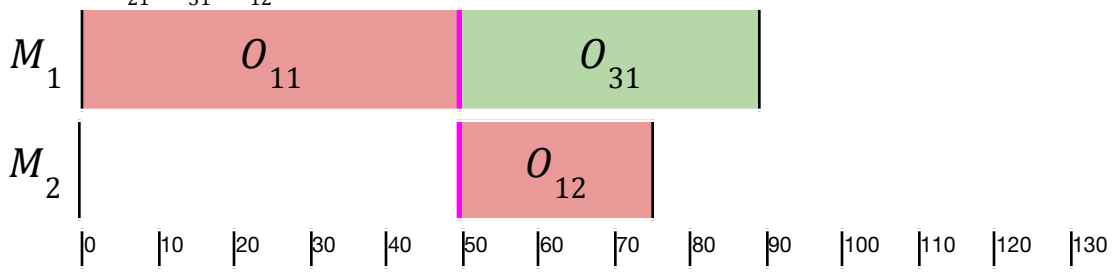
$J_3 = 110$

Therefore, the **makespan**, which is the maximum of these times, is 125.

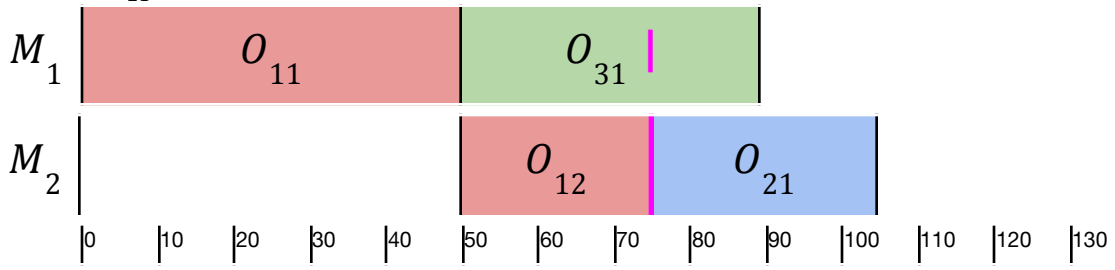
3. Going step by step; our first selection is only O_{11}, as it has an arrival time of 0



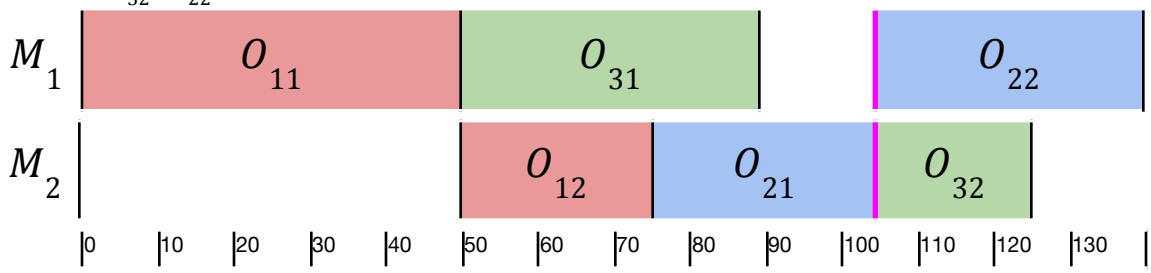
Domain: O_{21}, O_{31}, O_{12}



Domain: O_{21}



Domain: O_{32}, O_{22}



4. Completion times:

   $J_1 = 075$

   $J_2 = 140$

   $J_3 = 125$

   Therefore, the **makespan**, which is the maximum of these times, is 140.

   This is 15 units slower than FCFS. In this situation it is unwise to use SPT.

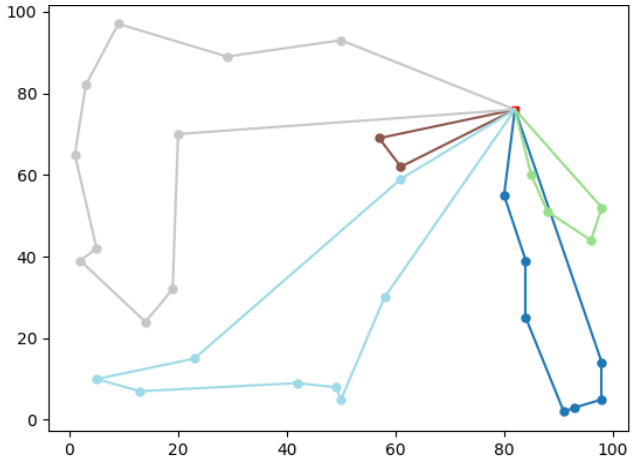
5. This does not mean FCFS is a better algorithm. It just works better for this example. A different scenario would show wildly different results in terms of improvement or diminishment.

   The advantages of SPT are also found in its dynamic nature. It can adapt on the fly to a change in circumstance. FCFS would need to recalculate a lot of steps to fit any changes in.

Part 2:

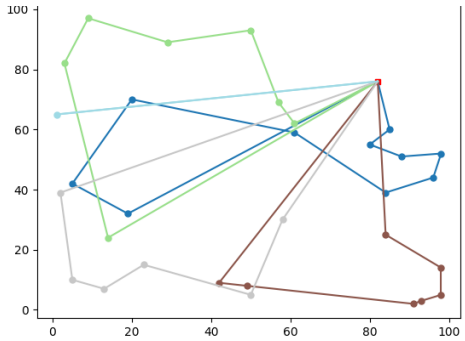
n32-k5

Optimal:



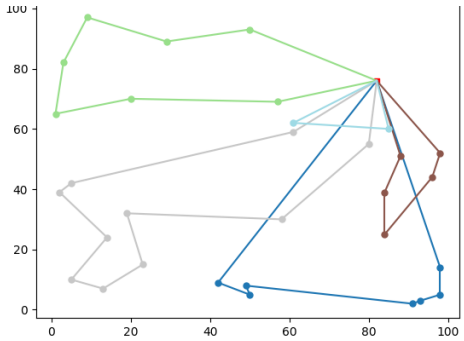
Cost: 784

Nearest Neighbour:



Cost: 1146.3996317253793

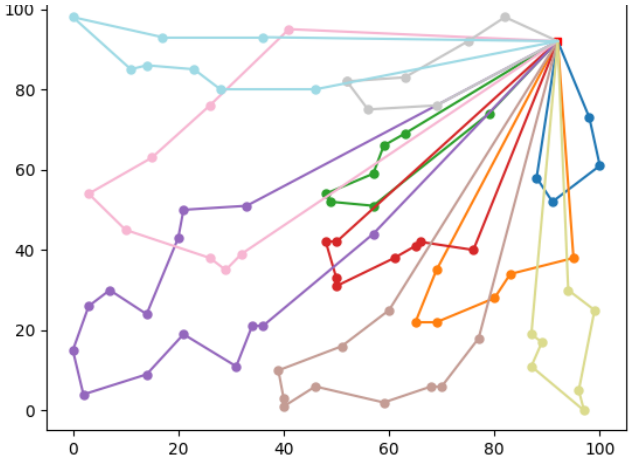
Savings:



Cost: 843.6881693466269

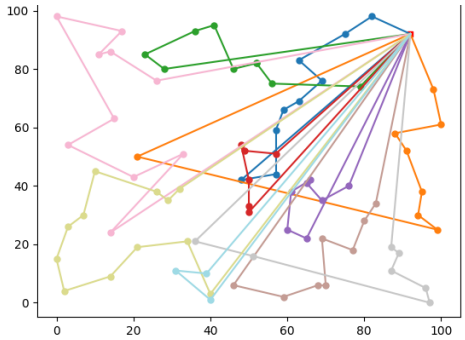
n80-k10

Optimal:



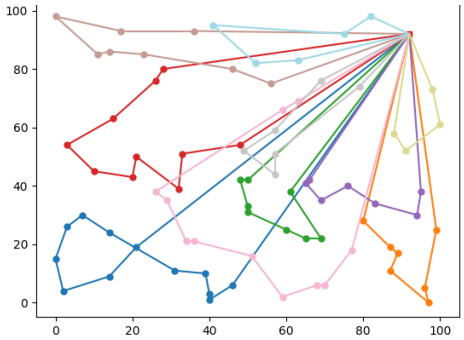
Cost: 1763

Nearest Neighbour:



Cost: 2255.461886842153

Savings:



Cost: 1836.8389976301548

In both datasets the order of cost is as follows:

Optimal < Savings < Nearest Neighbour

This indicates that Savings results in a better cost than naively picking the closest option. This indication is further backed up by the difference between optimal and savings, and savings and nearest neighbour;

$$843.7 - 784 = 59.7 < 302.7 = 1146.4 - 843.7$$

$$1836.8 - 1763 = 73.8 < 418.7 = 2255.5 - 1836.8$$

Savings is a lot closer in both cases to the optimal solution than it is to the nearest neighbour solution.

Though neither heuristic is optimal, the Savings heuristic will provide a much closer approximation than the Nearest Neighbour heuristic.