Scheduling

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Some tasks

- Load dishwasher
- Put bin out
- Mop floor
- Put clothes washing
- Clean microwave
- Vacuum living room
- Empty bins
- Unload dishwasher
- Put clothes away

How do you plan to do these tasks? What do you need to know?

- I imagine you might need to know: urgency, precedence, duration.
- Some possible approaches:
  - immediately do quick tasks and tick them off
  - start with the most difficult task
  - start with the longest task
  - start the task with the most dependencies

Scheduling laundry

- You have several loads of washing to wash and dry.
  1. Regular load: 110 mins wash, 120 mins dry.
  2. Heavily soiled: 140 mins wash, 120 mins dry.
  3. Sensitive load: 110 mins wash, 160 mins dry.
- In which order do you wash these loads?

One approach

- Find the shortest step.
- If it's a wash, do that load first.
- If it's a dry, do that load last.

Machine scheduling

- In operational research, one class of problems concerns scheduling one or more machines in a process, perhaps in a production line.
- Our washing problem is a two-machine problem.
- The household chores problem was a single-machine scheduling problem.

Single machine scheduling

- If you are doing all the tasks, all schedules take equally long.
- This means the order is irrelevant — unless there are other factors.
- Key question: what are we trying to optimise? What are our goals? What does ‘best’ look like?

Tasks with due date

- Lateness is how overdue tasks are.
- You might wish to minimise maximum lateness.
- For example: a restaurant may aim to serve people in the order they arrived.

Meal planning

- Say you have a fridge with various foods in it, each of which has a ‘due date’ (i.e. ‘use by’ date).
- Order food by use by date, and simply eat in this order.
- So you have cake for breakfast, porridge for lunch, broccoli and strawberry jam for tea . . .

Meal planning

- Say you have a fridge with various foods in it, each of which has a ‘due date’ (i.e. ‘use by’ date).
- Order food by use by date, and simply eat in this order.
- So you have cake for breakfast, porridge for lunch, broccoli and strawberry jam for tea . . .
- Perhaps you have other considerations.

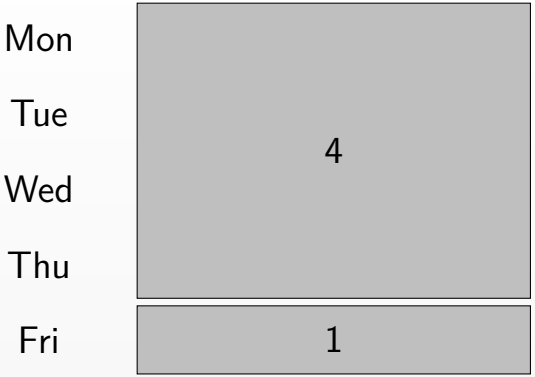
Meal planning

- What if you simply don't have time to eat all the foods in time?
- Do you try to minimise the total lateness, or minimise the number of items that spoil?
- Moore's algorithm aims to minimise the number of items with missed dates:
  - Schedule in order by due date.
  - Whenever we get to an item where we'll miss the date, look back over the list so far and reject the 'biggest' item (the one that would take longest to complete, e.g. most meals to get through),
  - Repeat.

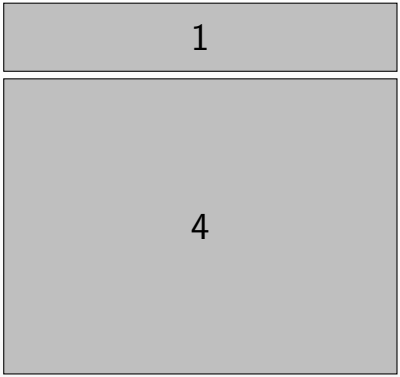
Waiting time

- On Monday morning, you have two tasks to do:
  - A four-day project for Customer 1.
  - A one-day project for Customer 2.
- How do you schedule these?

Waiting time



Customer 1 waits 4 days
Customer 2 waits 5 days
Total: 9 days



Customer 1 waits 5 days
Customer 2 waits 1 day
Total: 6 days

Waiting time

- This is ‘sum of completion times’.
- Suggests always doing the quickest task first.

Some tasks with times

- Put kettle boiling (1 min).
- Put saucepan away (30s).
- Put shopping in fridge (2 mins).
- Put out fire and clean up (5 mins).

Priority

- If items have a priority, give them a weight.
- Then minimise the sum of weighted completion times:
  - Divide weights by duration.
  - Then work from highest value.
- (In some cases, weights might be money, and thus we are working on hourly rate.)