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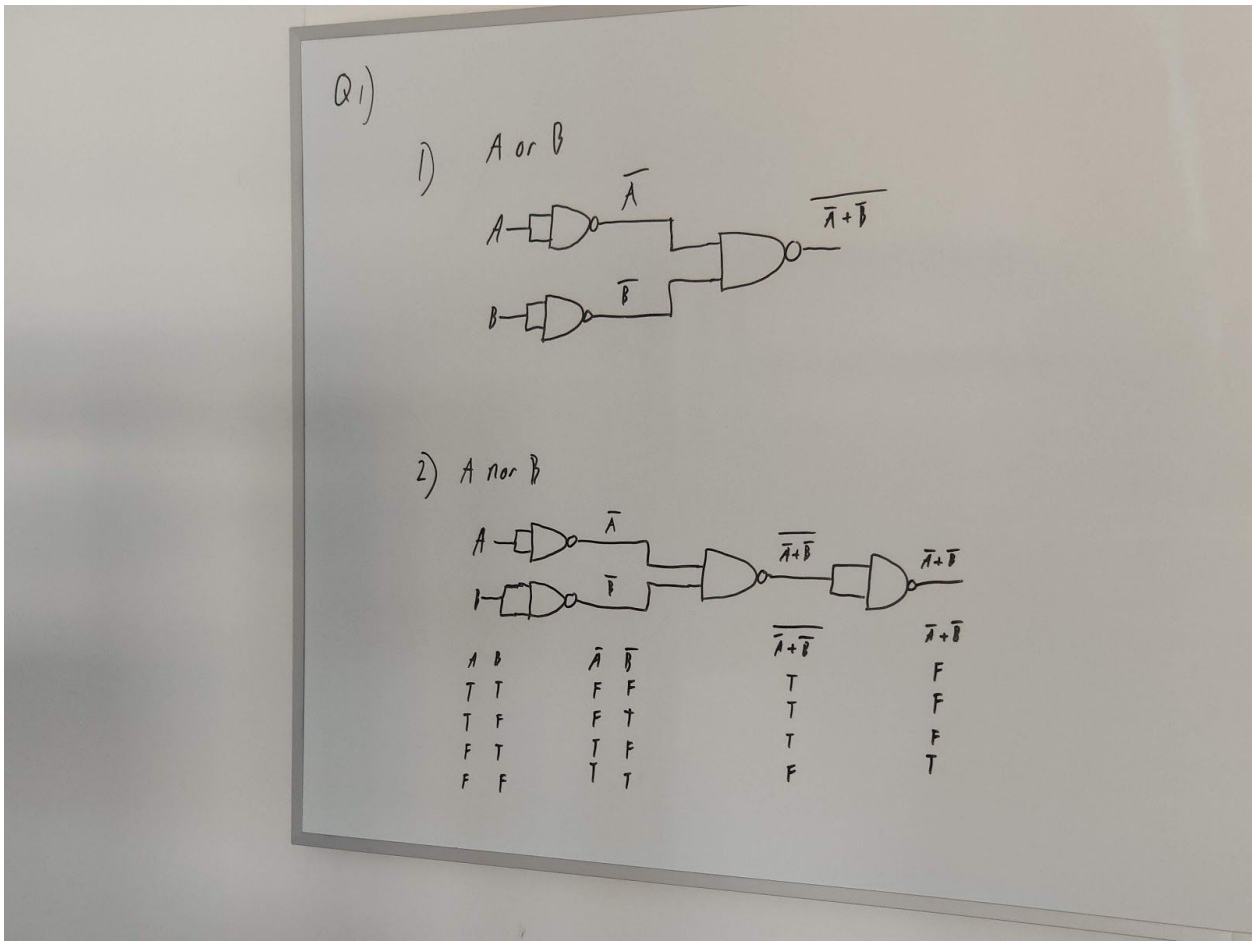
Q1)



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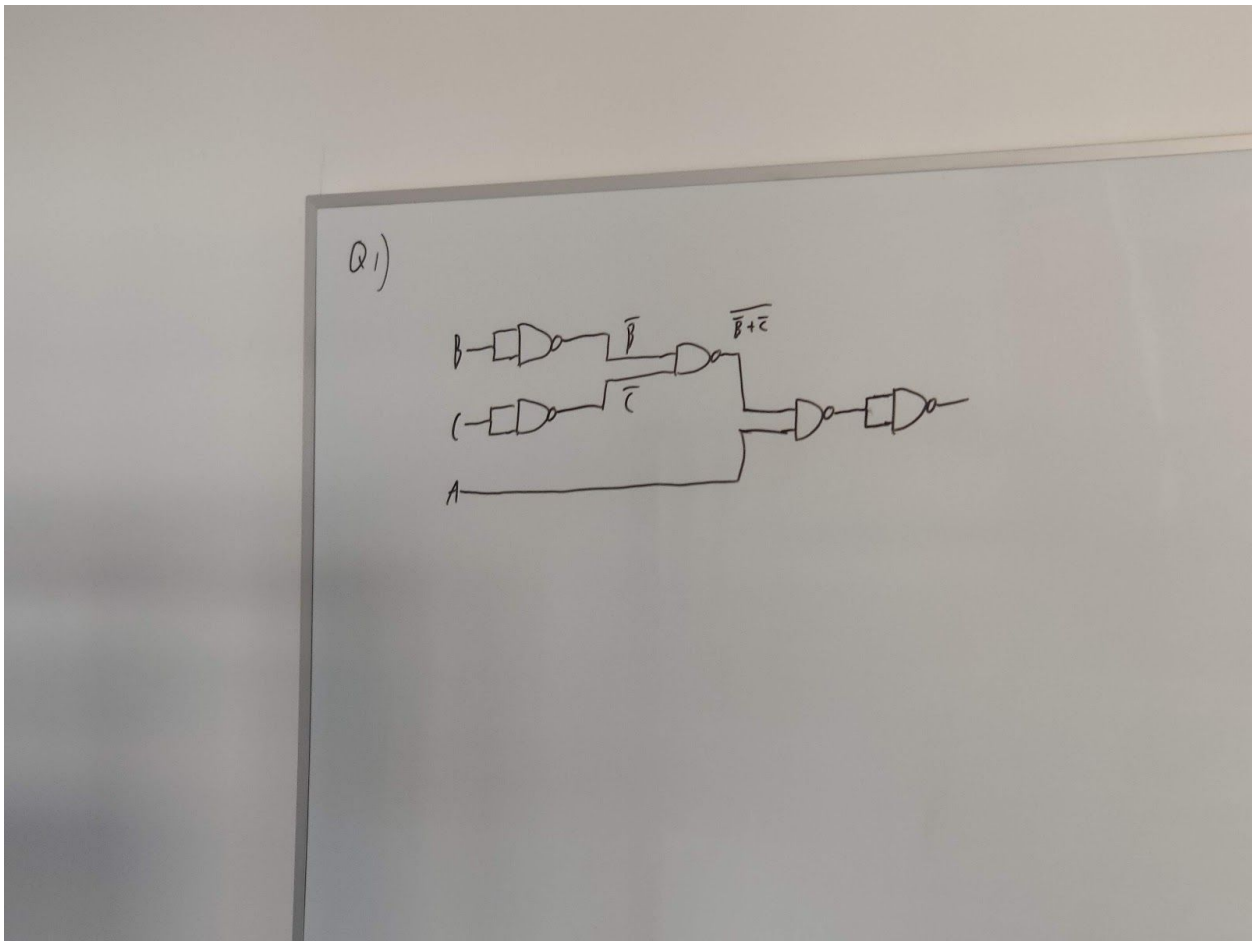

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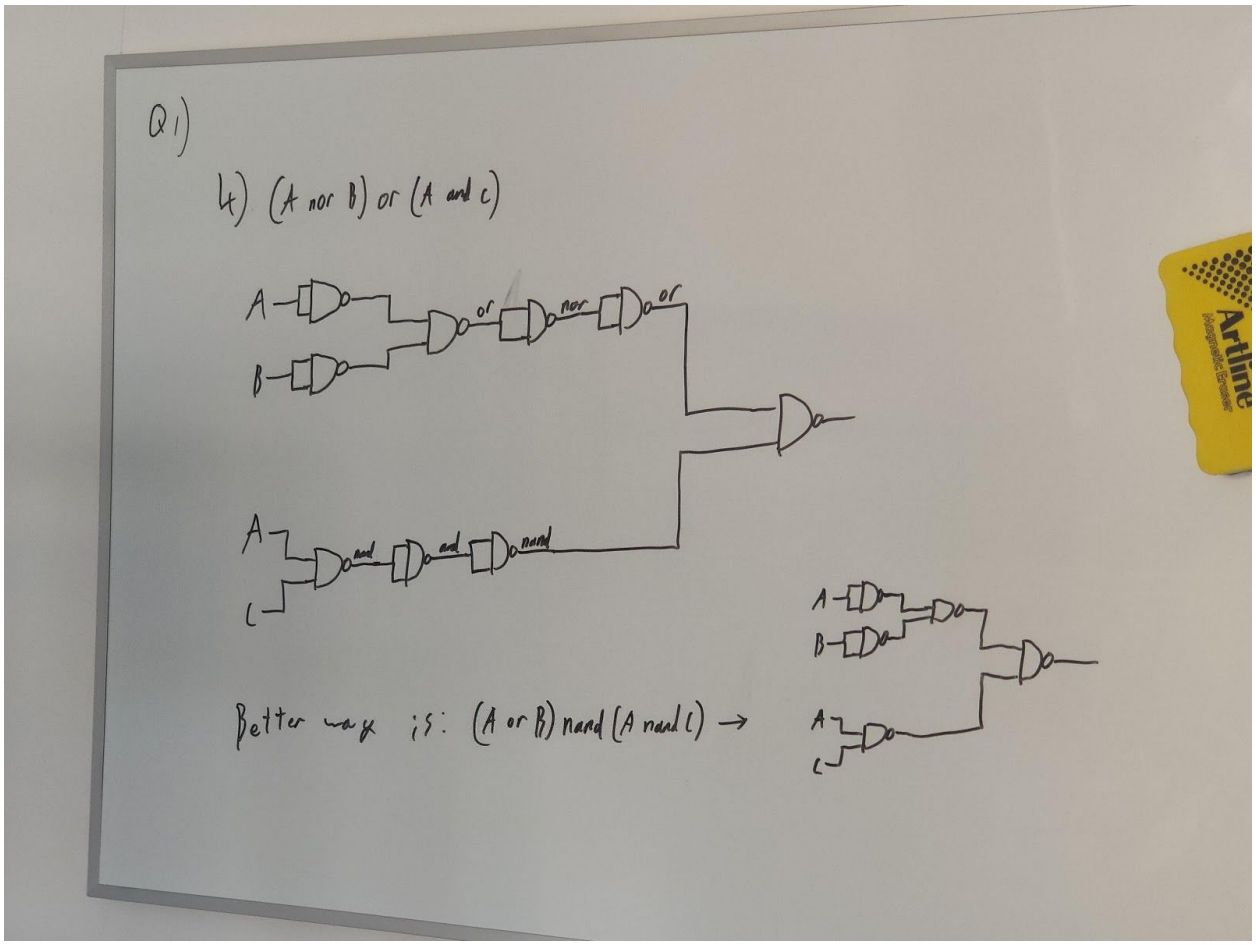

Q2) Seven state process model: States and transitions.

- **New**: A process entering the core for the first time.
  - → Ready: A new process can enter the ready state once it is loaded in memory.
  - → Ready/Suspend: If memory is full, the new process can move into secondary memory.
- **Ready**: A process ready and waiting in memory to be picked up by the core.
  - → Running: When a scheduler decides to pass the process into the core.
  - → Ready/Suspend: If memory is full, the process may be moved into secondary memory.
- **Ready/Suspend**: A process ready to be picked up but memory is full, so it's suspended in secondary memory.
  - → Ready: If there is enough memory available, a process can be moved into the ready state.

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- **Running**: A process currently being run by the core.
    - → Exit: If the process finishes all its operations.
    - → Ready: If the process is interrupted.
    - → Ready/Suspend: If the process is interrupted and memory is full.
    - → Blocked: If the process is waiting for an event.
- **Blocked**: A process waiting in memory for an event such as an I/O response.
    - → Blocked/Suspend: If memory is full, the process may be moved into secondary memory.
    - → Ready: If the process's awaited event occurs.
- **Blocked/Suspend**: A process waiting for an event but memory is full, so it's suspended in secondary memory.
    - → Ready/Suspend: If memory is full, the process may be moved into secondary memory.
    - → Blocked: If there is enough memory available, a process can be moved back into the blocked state.
- **Exit**: A process once it's completed all its operations.

Originally, the earliest computers used first-come-first-served (FCFS). This worked fine, except when computers needed to become multi-user-interactive. Computers evolved to quickly switch between tasks such that each user could have their own terminal for interacting with the computer.

Then as operating systems evolved into more user-friend interfaces, more and more processes were being run simultaneously. It quickly became a necessity to use a system of process states to improve usability and efficiency. There are various process models, but most operating systems today utilise a 5 or 7 state process model.

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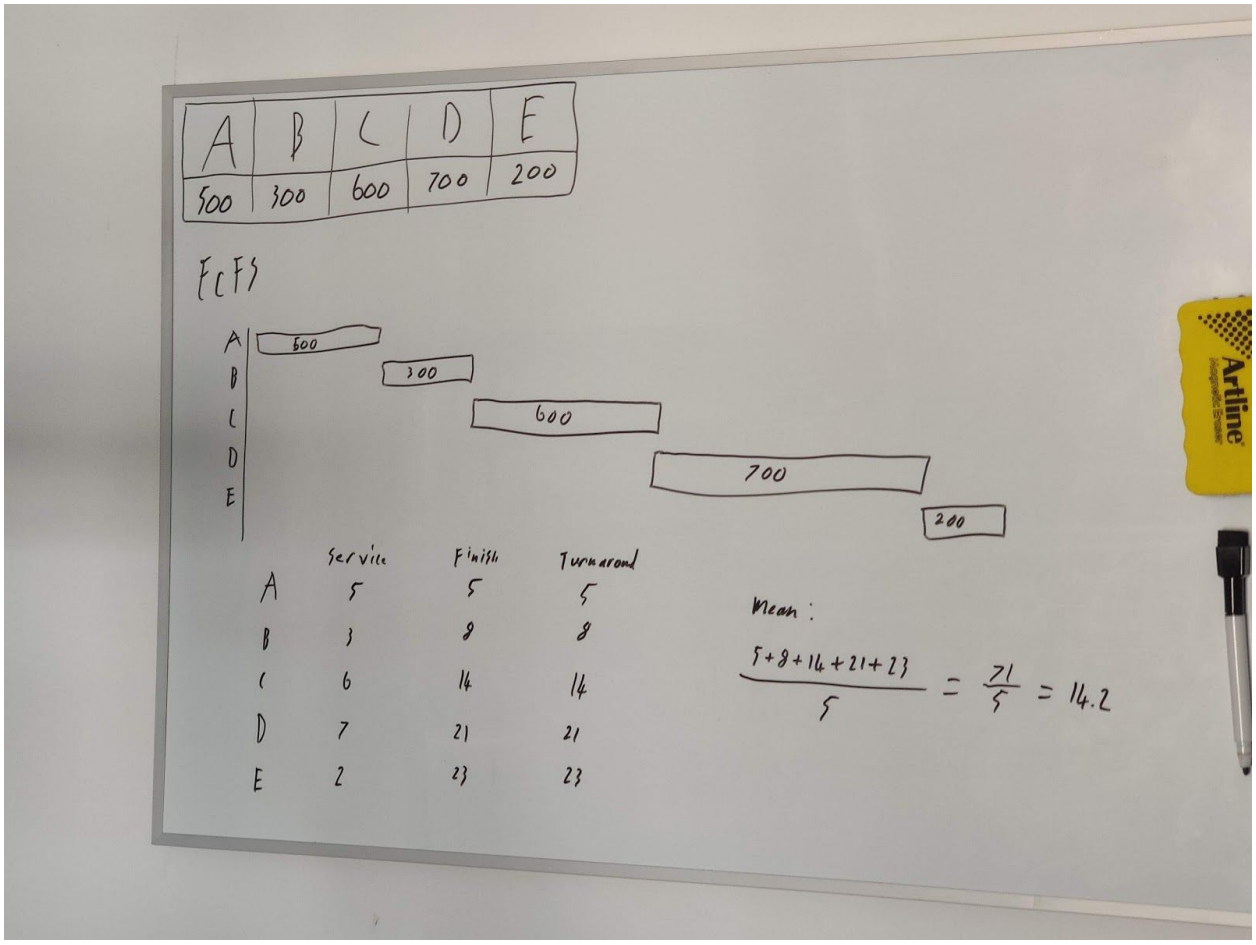
Q3) NOTE: Some numbers are divided for simplicity.



14.2 meaning 14.2*100ms or **1420ms**

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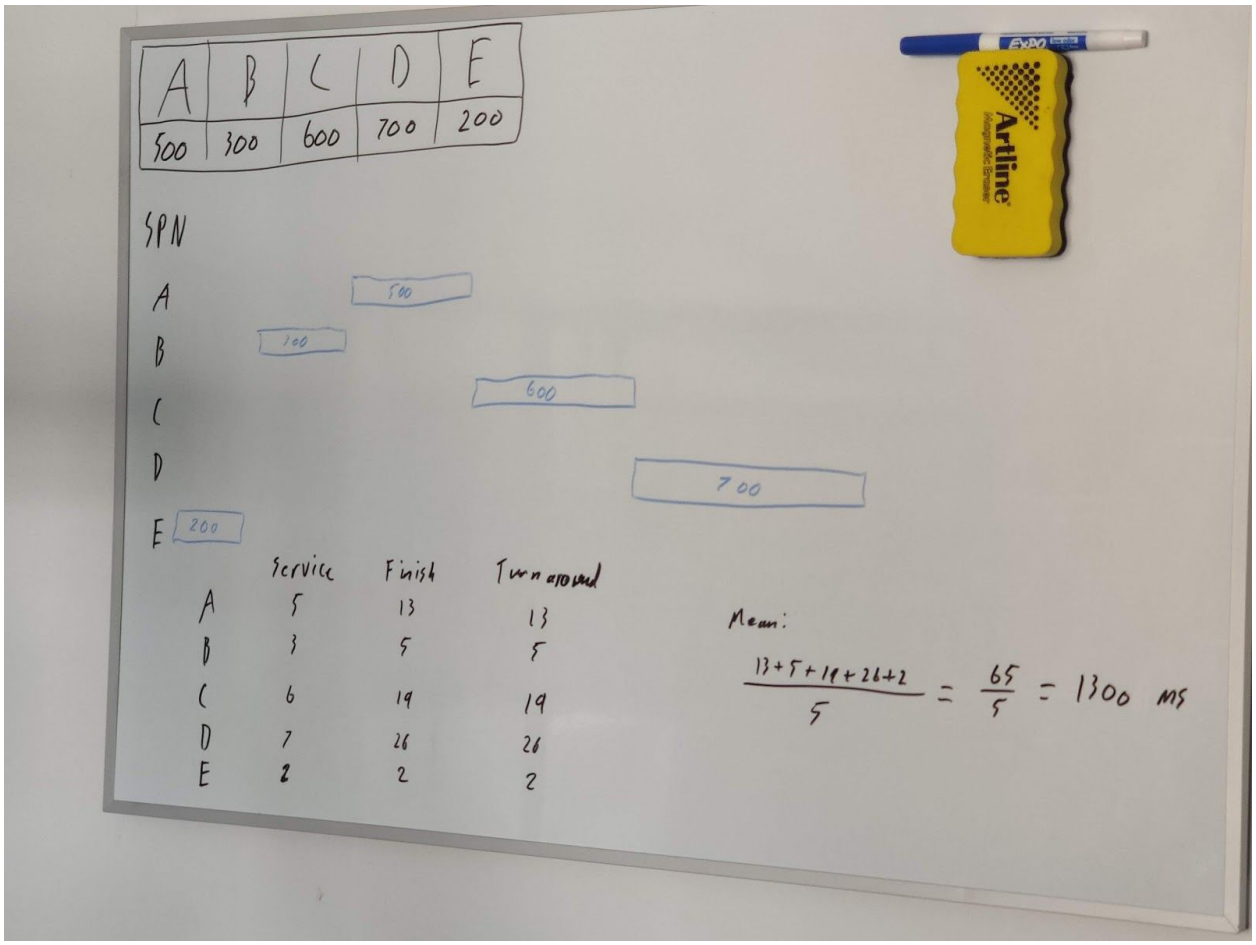

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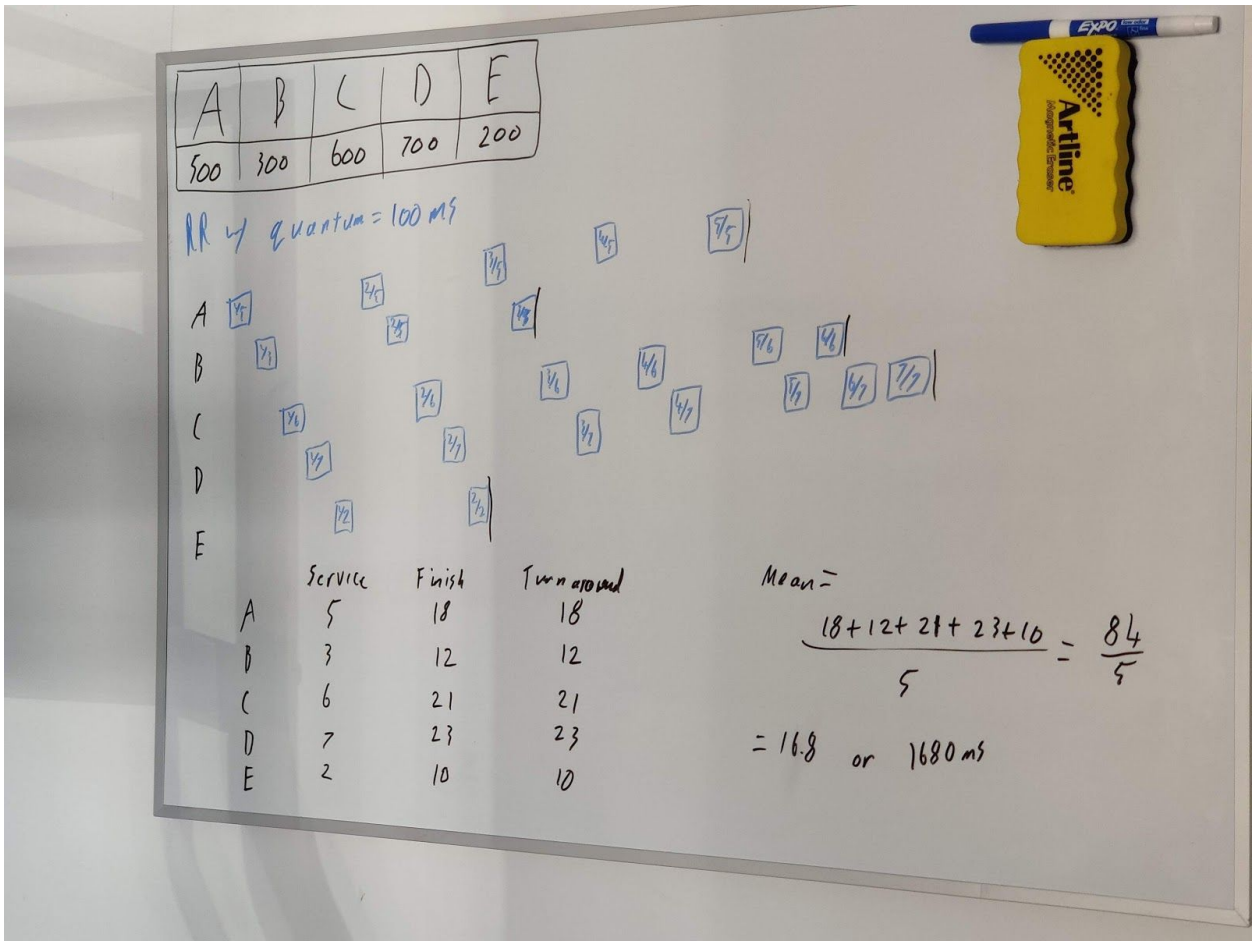

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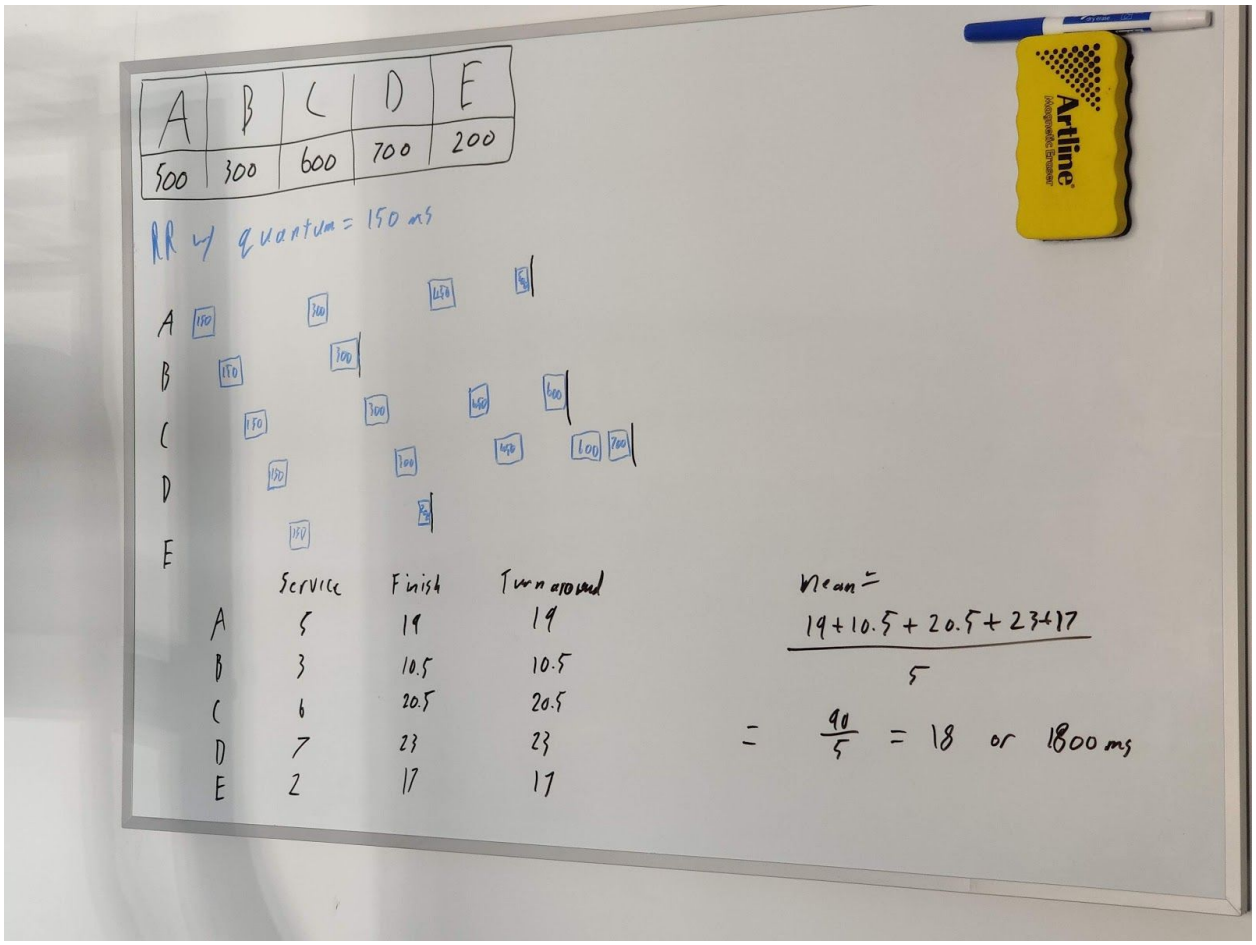

Q4) This does solve the mutual exclusion problem because one process can be waiting in the while loop if or until the other process is not in its critical section.

Q5)

To move from track 7 to 33 is (33-7) 26 cylinder movements

2ms per cylinder movement

26*2 = 52ms

rotational wait time = 6ms

disk read time is 100MB/s or 0.1MB/ms

reading 5MB will take (5/0.1) 50ms

Therefore, total data read time = (52+50+6) **108ms**