MEL 322: Operations Planning and Control

Major Exam, Max Marks 40, Duration 2 hr.

Part 1:

Q1. Aggregate Planning

Forecasted demand over the next 4 months from September to December for a product is: 900, 670, 850, 1200

In the past, the plant manager observed that over 18 working days with 80 workers employed, the plant produced 250 units of the product. (5)

The number of working days from September to December is as follows:

Month	No. of working days
September	20
October	25
November	20
December	25

The plant follows **a constant workforce policy** wherein a constant workforce is maintained throughout the period from September to December.

What should the level of the constant workforce be?

In this plan, how much ending inventory is carried in total from September to December?

Q2. Inventory Management (5)

How are holding costs measured? Describe the components of holding costs. Describe fixed order costs and penalty costs.

What is the difference between known time variable demand and random demand?

Q3. Inventory Management (5)

Every Sunday, Mac, the owner of a local newsstand, purchases a number of copies of the Computer Journal, a popular weekly magazine. He pays $7 for each copy and sells each for $10. Copies that he has not sold during the week, can be returned to the supplier for $5. A study of the historical data, showed that demand during the week is normally distributed with mean 12 and standard deviation 5.

How many copies of the magazine should be purchased each Sunday to minimize average overage and underage costs?

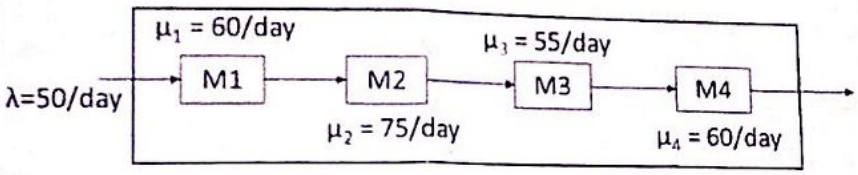
Let $\phi(.)$ be the standard normal cumulative distribution. We have,

$\varphi^{-1}(0.4) = -0.2533$, $\varphi^{-1}(0.6) = 0.2533$ and $\varphi^{-1}(0.8) = 0.8416$.

Choose whichever one value from the above, that you think is most suitable for your calculation.

Part 2:

Q1: Consider a serial production system (with 4 machines) in steady state with arrival rate and processing rates given below. Assume the processing times and time between arrivals to be exponentially distributed. Also assume the number of jobs in the system to be Poisson distributed and queue discipline to be First Come First Serve (FCFS).

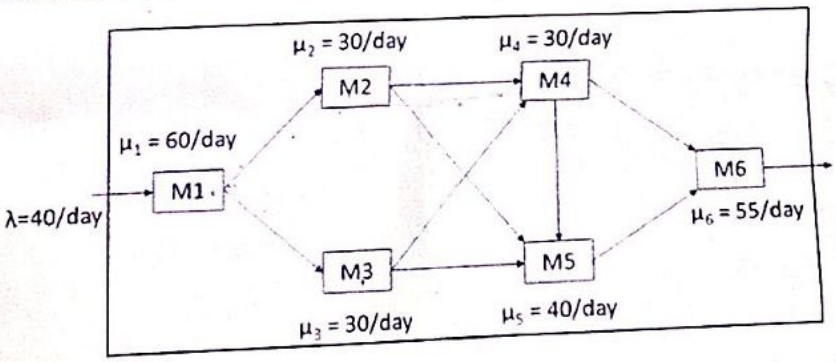


Design a CONWIP control mechanism for the above system and explain it's working in brief (3)

What will be the mean flow time for a job entering the system? (1)

If the third workstation is duplicated, what will be the % improvement in terms of average work in process inventory and the lead time for jobs entering the system? (1)

Q2: Consider a job shop with a configuration as shown in the figure with the arrival rate and the machine processing rates. Assume the processing times and time between arrivals to be exponentially distributed. Also assume the number of jobs in the system to be Poisson distributed and queue discipline to be First Come First Serve (FCFS). The system is in a steady state. Assume that the output streams of m/c 1, 2, 3 and 4 split the output rate into half.



If the POLCA production control mechanism is to be implemented, determine the number of POLCA cards of each pair in the system. (3)

If the following jobs (routing given in brackets) enter the system, what will be the expected lead time for each one of them? (2)

Job A(M1-M2-M4-M6), Job B(M1-M3-M4-M5-M6)

What are the three criteria for releasing jobs in to the system? Explain the logic behind these. (4)

How will you apply these to any one of the above two jobs throughout the system? (2)

If the average waiting for jobs is to be reduced, what needs to be done? Use a numerical example to show the improvement and the corresponding changes to be made to the POLCA system. (3)

What will be the average work in process inventory in the system before and after improvement? (1)

Q3: Using a numerical example of your own, show how production can be managed using the minimal part set concept for cyclic production in a high volume low mix environment. (5)