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course : Computer Networks for communication

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Assignment

Unit - IV

Scenario: A sensor network uses a network of the queues for event processing.

parameters: 3 nodes in series, each with $\lambda = 10/s$ $\mu = 15/s$

Questions:

1) What is total end-to-end delay assuming independence?

Ans) 1. Identify all types of delays involved:

- Transmission Delay
- processing Delay
- propagation Delay
- Quening Delay

2. Use the formula for total delay:

Total end-to-end delay: $T_{trans} + T_{prop} + T_{proc} + T_{queene}$

3. Calculate the delay indivually

- Transmission Delay = $\frac{\text{packet size}}{\text{Transmisson Rate}}$
- propagation delay = $\frac{\text{Distance}}{\text{propagation speed}}$
- processing Delay: Time taken by routes to process
- Quening day = Time a packet waits in routing

4. Assume delays are independent:

- Treat each delay as a seperate the non-overlapping factor

Total Delay: $N \times (T_{trans} + T_{prop} + T_{proc} + T_{quene})$

Question:-

a) what is average queue length at each node?

Ans) 1. Use Little's Law formula:-

Ans) $L = \lambda \times W$

where

- L = Average queue length
- λ = Arrival rate
- W = Average queuing delay

2. Identify or calculate values:-

=> Find the arrival rate (λ) at each node

=> Find or estimate the average time a packet waits in the queue

3. Substitute values into the formula

=> multiply arrival rate and queuing delay to get average queue length.

4. Interpret the result:-

=> The result gives the average number of the packets waiting in the queue at each node

example:-

- $\lambda = 800$
- $W = 0.005$

Then

$L = 800 \times 0.005 = 4$ packets

Question: 3

3) What is total queue length for the system.

Ans) 1. Identify the queueing model
- Example: M/M/1, M/M/c, M/G/1 etc.
- Each model has different formulas

2. Note the given parameters.
- λ (lambda) = arrival rate
- μ (mu) = service rate
- c = number of servers

3. Calculate traffic intensity (ρ)
- $\rho = \lambda / (c \times \mu)$
- For M/M/1 system $\rho = \lambda / \mu$
- Ensure $\rho < 1$ for stable system

4. Use the appropriate formula
> $L = \rho / (1 - \rho)$
> This is the average number of customers in system

5. Substitutes value into the formula
- plug in λ and μ into the formula
- calculate L_q (queue length)

6. Intrepret the result:
- L_q = average number of customers in the queue
- L = average number in the system.