Examination : Final Examination

Date : 24 Feb 2005

Subject : 240-361 Introduction to Queueing Theory

Academic year : 2004

Time : 13:30 – 16:30

Room : R200

NOTE

- There are 4 questions, 8 pages (not include cover). Answer all questions.
- All questions are different marks.
- Calculator, textbooks and hand-out are prohibited.
- Each answer must be clear and <u>show how to get the answer</u>.

Student ID : _____ Name : _____ Section : _____

Question	1	2	3	4	Total
Marks					

1. Consider a packet stream whereby packets arrive according to Poisson process with rate 10 packets/sec. If the interarrival time between any two packets is less than the transmission time of the first to arrive, the two packets are said to collide. Assuming the link capacity is fixed with C=10 Mbps and packet length is 10 Kb. *Find the probabilities that a packet does not collide with either its predecessor or its successor, and that a packet does not collide with another packet?* (10 marks)

Answer_____

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2. A communication line capable of transmitting at a rate of 60 Kbits/sec will be used to accommodate 10 sessions. Each session generates Poisson traffic. For the case where five of the sessions transmit at a rate of 300 packets/min while the other five transmit at a rate of 60 packets/min. Packet lengths are exponentially distributed with mean 1000 bits. *Find the average number of packets in queue, the average number in the system, and the average delay per packet when the line is allocated to the sessions by using*

   (a) 10 equal-capacity time-division multiplexed channels.   (18 marks)

Answer_____

(b) Statistical multiplexing.   (10 marks)

Answer_____

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3. In M/M/2 queueing system, *derive the following in term of μ and λ*

   (a) P_n (5 marks)

Answer_____

(b) N : average number of packets in the system   (5 marks)

Answer_____

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(c) T : average waiting time in the system   (2 marks)

Answer_____

4. An M/M/1 queueing system in which the total number of jobs is limited to K owing to a

limitation on queue size. Given $P_n = \dfrac{1-\rho}{1-\rho^{K+1}} \cdot \rho^n$

   (a) Find the steady-state probability that the processor is idle.   (2 marks)

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   (b) Find the steady state probability that an arriving request is rejected because the

      queue is full.   (2 marks)

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(c) Find the throughput of the system in the steady state.   (3 marks)

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(d) If $m_q(r)$ is the maximum number of packets in the system, how many packets in system for the 90th percentile?   (5 marks)

Answer_____

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