Quality of Service
degree

UNIVERSITAT POMPEU FABRA

Date: Spring
Duration: 15 min.

- There is only one correct answer for each multiple choice question.
- Each correct answer adds 1 point.
- Each incorrect answer has a penalty of $\frac{1}{3}$ points.
- No score is awarded for unanswered questions, neither positive nor negative.
- Mark out your answers with an "X".
- No score is awarded if you mark more than one answer.

Write your personal data clearly.

Last name:	
First name:	
Group:	

Permutation: A

NIA:

	A	B	C	D
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1.- What are the implications of the PASTA theorem?

(a) In a system with poisson packet arrivals, it is sufficient to check which is the system state at the moment of packet arrivals to derive time averages.
(b) Little's theorem can be generalized to systems with a Poisson arrival provess.
(c) It is the complementary result to the PESTO property.
(d) In a buffer with different priorities, the waiting time is the same for all the arriving packets that follow a Poisson distribution.

2.- What is the memoryless property of the exponential distribution? For an exponentially distributed random variable T ...

(a) $Pr(T > s + t|T > s) = Pr(T > s)$ for all $s, t \geq 0$.
(b) $Pr(T > s + t|T > s) = Pr(T > s + t)$ for all $s, t \geq 0$.
(c) $Pr(T > s + t|T < s) = Pr(T > s + t)$ for all $s, t \geq 0$.
(d) $Pr(T > s + t|T > s) = Pr(T > t)$ for all $s, t \geq 0$.

3.- What do we obtain if we merge two Poisson processes?

(a) Another Poisson process with a rate equal to the sum of the two original ones.
(b) An Erlang-2 process with a rate equal to the sum of the two original ones.
(c) An Erlang-2 process with a rate equal to the product of the two original ones.
(d) Another Poisson process with a rate equal to the product of the two original ones.

4.- Which of the following is the pdf of an exponential distribution with parameter λ?

(a) $f(x; k; \theta) = \frac{1}{\theta}\frac{1}{\Gamma(k)}x^{k-1}e^{-\frac{x}{\theta}}$
(b) $f(k; \lambda) = \frac{\lambda^k e^{-\lambda}}{k!}$.
(c) $F(x; \lambda) = \begin{cases} 1 - e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$.
(d) $f(x; \lambda) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$.

5.- What is the distribution of the interarrival time for a Poisson process?

(a) Poisson
(b) Erlang-10
(c) Exponential
(d) Hyperexponential

6.- A packet buffer has a random early discard dropper. If the buffer is empty, it accepts all the packets. If there is one packet, it drops 25 % of the incoming packets. If there is two packets, 50 %. If there is three packets, 75 %. If there are four packets, it drops all the incoming packets. Packets arrive following a Poisson arrival and the average interarrival time is 3 ms. Service time is exponentially distributed, with an average of 3 ms. Determine the mean sojourn time of the accepted packets in ms.

(a) $4 < T \leq 5$.
(b) $3 < T < 4$.
(c) $6 < T \leq 7$.
(d) $5 < T \leq 6$.

7.- Imagine a packet network that accepts 1 packet per second, and all the packets are delivered (no packet loss occurs). If the average delay suffered by the packets is three seconds, which is the average number of packets in the network?

(a) More than one packet and less than three packets.
(b) Three packets.
(c) One packet.
(d) 0.33 packets.