

# Midterm Exam

CS232/NetSys201/EECS248 - Fall 2025

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- Partial and unsatisfactory answer/solution will receive a fraction of the points, whereas excellent answers may exceed the indicated points.
- Use of books/notes is forbidden.
- Put your answer into the box below for Q1-Q10

Q1	Q2	Q3	Q4	Q5
d	c	a	a	a
Q6	Q7	Q8	Q9	Q10
b	a	a	a	b

**Q1** (6pt) Consider an exponentially distributed r.v.  $X$ . We know that  $X > s$ . Define  $Y$  as the residual  $t - s$ , with  $t > s$ . We then have:

- $P(X > s) = P(X > t)$
- $P(Y > t) = P(X > t)$
- $P(X > t) = 1$
- $P(Y > t | X > s) = P(X > t)$

**Q2** (6pt) Consider a set of random variables  $X_1, X_2, \dots, X_N$ . The variables are independent and distributed according to exponential distributions with parameters  $\lambda_1, \lambda_2, \dots, \lambda_N$ . The probability that the smallest value is associated with variable  $i$  is

- $\lambda_i$
- $\lambda_1 + \dots + \lambda_N$
- $\lambda_i / (\lambda_1 + \dots + \lambda_N)$
- $(\lambda_1 + \dots + \lambda_N) / \lambda_i$

**Q3** (6pt) In the same setting as the previous question. Define  $X = \min(X_1, X_2, \dots, X_N)$  and  $\lambda = \lambda_1 + \lambda_2 + \dots + \lambda_N$ . We then have

- $P(X > t) = e^{-\lambda t}$

- b)  $P(X > t) = e^{\lambda t}$
- c)  $P(X > t) = e^{-t}$
- d)  $P(X > t) = e^{t/\lambda}$

**Q4** (6pt) HTTP has a

- a) Client-Server architecture
- b) Peer-to-Peer architecture
- c) a Hybrid architecture

**Q5** (6pt) Email applications have a

- a) Client-Server architecture
- b) Peer-to-Peer architecture
- c) a Hybrid architecture

**Q6** (6pt) In the internet, resource sharing is

- a) Deterministic
- b) Statistical

**Q7** (6pt) In the telephone network, resource sharing is

- a) Deterministic
- b) Statistical

**Q8** (6pt) Compared to that of trunks, the capacity of telephone network's local loops typically is

- a) Smaller
- b) Larger

**Q9** A Poisson process generates events at rate  $\lambda$ . Each event is **discarded** with probability  $p$ . At time  $T$ , what is the expected time to the next (non discarded) event?

- a)  $1/((1 - p)\lambda)$
- b)  $1/(p\lambda)$
- c)  $(1 - p)\lambda$
- d)  $\lambda/p$

**Q10** (6pt) In HTTP, packet loss is

- a) Ok
- b) Not Ok

**Q11** (10pt) List and discuss the characteristics of the “voice” application that led to the design of the telephone network.

**Q12** (10pt) Describe the terms: “Synchronous”, “Connection-Oriented” and “Reliable” in the context of communication networks. Are the telephone network and internet synchronous or asynchronous? Connection oriented or non-connection oriented? Reliable or non-reliable?

**Q13** (10pt) Fully connected, star and hybrid topology. Which one is the best choice in large scale networks? Explain your answer.

**Q14** Describe the characteristics of resource sharing in the internet routers.