

1. Suppose a cellular telephone is equally likely to make zero handoffs (H_0), one handoff (H_1), or more than one handoff (H_2). Also, a caller is either on foot (F) with probability $5/12$ or in a vehicle (V). Suppose we also learn that $1/4$ of all callers are on foot making calls with no handoffs and that $1/6$ of all callers are vehicle users making calls with a single handoff. Given these additional facts, find all possible ways to fill in the table of probabilities.

Probability table

| | H_0 | H_1 | H_2 |
|---|-------|-------|-------|
| F | p_0 | p_1 | p_2 |
| V | q_0 | q_1 | q_2 |

Answer _____

2. In a packet voice communications system, a source transmits packets containing digitized speech to a receiver. Because transmission errors occasionally occur, an acknowledgment (ACK) or a nonacknowledgment (NAK) is transmitted back to the source to indicate the status of each received packet. When the transmitter gets a NAK, the packet is retransmitted. Voice packets are delay sensitive and a packet can be transmitted a maximum of d times. If a packet transmission is an independent Bernoulli trial with success probability p , answer the following questions. What is the PMF of T , the number of times a packet is transmitted? (marks)

Answer _____

3. To communicate one bit of information reliably, cellular phone transmit the same binary symbol five times. Thus the information “zero” is transmitted as 00000 and “one” is 11111. The receiver detects the correct information if three or more binary symbols are received correctly. What is the information error probability $P[E]$, if the binary symbol error probability is $q = 0.1$?

Answer _____

4. The probability of a bit error in a communication line is 10^{-1} . Find the probability that a block of 1000 bits has five or more errors

Answer _____

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5. Connection requests arrive at a server according to a Poisson process with intensity $\lambda = 5$ requests in a minute.

(a) What is the probability that exactly 2 new requests arrive during the next 30 seconds?

Answer _____

(b) If a new connection request has just arrived at the server, what is the probability that it takes more than 30 seconds before next request arrives?

Answer _____

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6. A corporate Web server records hits (request for HTML document) as a Poisson process at a rate of 10 hits per second. Each page is either an internal request (with probability 0.7) from the corporate intranet or an external request (with probability 0.3) from the Internet. Over a 10-minute interval, what is the joint PMF of I , the number of internal requests, and X , the number of external requests?

Answer _____

7. A digital mobile phone transmits one packet in every 20-ms time slot over a wireless connection. With probability $p = 0.1$, a packet is received in error, independent of any other packet. To avoid wasting transmitter power when the link quality is poor, the transmitter enters a timeout state whenever five consecutive packets are received in error. During a timeout, the mobile terminal performs an independent Bernoulli trial with success probability $q = 0.01$ in every slot. When a success occurs, the mobile terminal starts transmitting in the next slot as though no packets had been in error. Construct a Markov chain for this system.

Answer

Answer _____

