มหาวิทยาลัยสงขลานครินทร์

คณะวิศวกรรมศาสตร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 2 ปีการศึกษา : 2547

วันที่ : 21 ธันวาคม เวลา : 13.30-16.30

วิชา : 240-361 Introduction to Queueing Theory ห้อง : ก200

ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียนหนึ่งภาคการศึกษา

<u>คำสั่ง</u>

1. ข้อสอบมี 6 ข้อ 10 หน้า (ไม่รวมปก)
2. ห้ามนำเครื่องคิดเลข, เอกสารใดๆ เข้าห้องสอบ
3. คำตอบทุกข้อเขียนให้ชัดเจนถ้าอ่านไม่ออกถือว่าตอบผิด

รหัสนักศึกษา : _____ ชื่อ :_____ตอน : ____

คำถาม	1	2	3	4	5	6	Total
คะแนน							

Student ID : _____ Name : _____ Section : _____

1. A fax transmission can take place at any of three speeds depending on the condition of the phone connection between the two fax machines. The speeds are high (h) at 14,400 b/s, medium (m) at 9600 b/s, and low (l) at 4800 b/s. In response to requests for information a company sends either short faxes of two (t) pages, or long faxes of four (f) pages. Consider the experiment of monitoring a fax transmission and observe the transmission speed and the length. An observation is a two-letter word, for example, a high speed, two-page fax is ht.

   (a) What is the sample space of the experiment? (2 marks)

Answer _____

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(b) Let A_1 be the event "medium speed fax". What are the outcomes in A_1? (2 marks)

Answer _____

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(c) Let A_2 be the event "short (two-pages) fax". What are the outcomes in A_2?

(2 marks)

Answer _____

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(d) Let A_3 be the event "high speed fax or low speed fax". What are the outcomes in A_3? (2 marks)

Answer

(e) Are A_1, A_2, and A_3 mutually exclusive? Why?(2 marks)

Answer

(f) Are A_1, A_2, and A_3 collectively exhaustive? Why?(2 marks)

Answer

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2. Monitor two consecutive phone calls going through a telephone switching office. Classify each one as a voice call (v), if someone is speaking; or a data call (d) if the call is carrying a modem or fax signal. Your observation is a sequence of two letters (either v or d). For example, two voice calls corresponds to vv. The two calls are independent and the probability that any one of them is a voice call is 0.8. Denote the identity of call i by C_i. If call $_i$ is a voice call, then $C_i = v$; otherwise, $C_i = d$. Count the number of voice calls in the two calls you have observed. N_V is the number of voice calls. Consider the three events $N_V = 0$, $N_V = 1$, $N_V = 2$. Determine whether the following pairs of events are independent or dependent:

   (a) $\{N_V = 2\}$ and $\{N_V \geq 1\}$ (4 marks)

Answer _____

(b) $\{N_V \geq 1\}$ and $\{C_1 = v\}$ (4 marks)

Answer _____

(c) $\{C_2 = v\}$ and $\{C_1 = d\}$ (4 marks)

Answer

3. A network server receives incoming requests according to a Poisson process with mean(λ) 2 per second.

   (a) What is the probability that between 1:00 pm and 1:02 pm the server receivers 100 incoming requests and between 1:02 pm and 1:04 pm the server receives 150 incoming requests? (3 marks)

Answer

(b) What is the probability that between 1:00 pm and 1:04 pm the server receives 250 incoming requests? (3 marks)

Answer

4. To communicate one bit of information reliably, cellular phones transmit the same binary symbol five times (this increases robustness to transmission noise). 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. Assume the probability that a bit gets flipped during transmission is equal to q = 0.1. Assume that "zeros" and "ones" are equiprobable.

   (a) What is the information error probability $P[E]$? (3 marks)

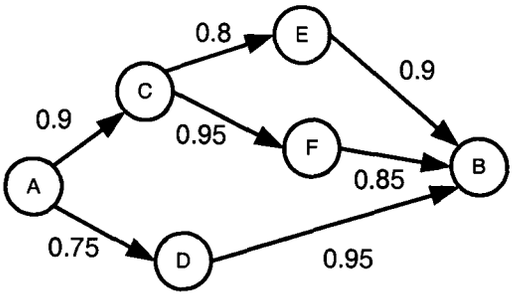
Answer

(b) If you receive the string 00110, what is the probability that the information transmitted was a "zero"? (7 marks)

Answer

Student ID : _____ Name : _____ Section : _____

5. A computer network connects two nodes A and B through intermediate nodes C, D, E, F as shown below. For every pair of directly connected nodes, say i and j, there is a given probability p_{ij} that the link from i to j is up. We assume that link failures are independent of each other. *What is the probability that there is a path connecting A and B in which all links are up?* (6 marks)



Answer

6. A database server system has 2 harddisks, one on-line and one standby. The operating harddisk fails after an exponentially distributed time, having mean 3 years and then it is replaced by standby harddisk, i.e., at any time only 1 or 0 harddisks are operating. There is one repair facility, i.e., at any time only 1 or 0 harddisks can be repaired. The repair times are exponentially distributed with mean 1 month. *What is the probability that the database server system will be down?* (6 marks)

Answer