Mansoura University
Faculty of Engineering
Math. & Eng. Phy. Dept.
Fall Semester
Wednesday 17/1/2018
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إحصاء

Probability & Statistics
Course code: MATH209
Final Exam,
CIE & BCE Students
Total Mark: 50
Time allowed: 2 hours

Answer the following questions

1st Question [12 marks]

(a) In a certain city telephone numbers have 10 digits. The first three digits are the area code (050) and are the same within a given area. The last 7 digits are the local number and cannot begin with 0. **How many** different telephone numbers are possible within a given area code in this city? [4 marks]

(b) If an aircraft is present in a certain area, the radar correctly registers its presence with probability 0.98. If it is not present, the radar falsely registers an aircraft presence with probability 0.06. An aircraft is present with probability 0.03.

(i) **What** is the probability of false alarm (a false indication of aircraft presence)?
(ii) **What** is the probability of correct alarm (a correct indication of aircraft presence)?
(iii) **What** is the probability of missed detection (aircraft is present and nothing registers)?
(iv) If the alarm is exist, **what** is the probability that aircraft is present? [4 marks]

(c) Three designers work independent, the probability that the first solve a problem is 0.6, the second solve a problem is 0.8 and the third solve a problem is 0.7. **Find** the probability that

(i) The problem will be solved.
(ii) The first designer solves the problem and the second does not solve it.
(iii) Neither the first designer nor the second solve it.
(iv) The first designer only solves the problem. [4 marks]

2nd Question [12 marks]

(a) A sample of 4 resistors is selected at random from a box containing 12 resistors of which 3 are defective. **Evaluate** the expected number of defective resistors. [4 marks]

(b) The number of typographical errors on a single page of a book has a Poisson distribution with average 2 errors per page. **Calculate** the probability that

(i) At least one error on single page.
(ii) 2 errors on two pages.
(iii) one error in page number 39 and two errors in page number 40. [4 marks]

(c) An electronic product contains 30 integrated circuits (I.C.) that work independent. The mean number of defective circuits in the product is 3. The product operates only if there is no defective I.C. **What** is the probability that the product will not operate? [4 marks]

3rd Question [12 marks]

(a) The probability density function of a continuous random variable is given by

$$f(x)=\begin{cases} e^{3x} & x \le 0 \\ kx^2 & 0 < x \le 1 \\ 0 & otherwise \end{cases}$$

(i) **Find** the value of k.

(ii) **Evaluate** the cumulative distribution function. [4 marks]

(b) (i) **Write** and **graph** the probability density function of continuous uniform distribution.

(ii) **deduce** for the above distribution that $\frac{V(x)}{\mu_x}=\frac{(b-a)^2}{6(b+a)}$. [4 marks]

(c) A production line manufactures 1000 ohm resistors that have 5% tolerance. Let X denotes the resistance of the resistor. X is a normal random variable with mean 1000 ohm and standard deviation 25 ohm. **Determine** the probability that a resistor picked at random will be rejected. [4 marks]

4th Question [14 marks]

(a) 500 ball bearings have a mean weight of 5.02 grams and standard deviation of 0.3 g. **Find** the probability that a random sample of 100 ball bearings chosen from this group will have an average weight between 5.02 g and 5.14 g. [4 marks]

(b) A material engineering test describes the results of tensile load on 10 alloy specimens. The mean load at specimen failure of the sample is 13.71 megapascal and standard deviation 3.55 megapascal. **Find** a 95% confidence interval on mean of population. [5 marks]

(c) A manufacturer of light bulbs states that the mean life of his bulbs is 1500 hours with a standard deviation of 100 hours. A sample of 64 bulbs was checked and the mean life was found to be 1460 hours. **At 2% level of significance can we reject the claim?** [5 marks]