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BICEE-020

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00812

December, 2017

BICEE-020 : RELIABILITY AND OPTIMIZATION OF STRUCTURES

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***ten*** *questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Bag A contains 2 white and 3 red balls and bag B contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from the bag A. 7

2. A and B are two events, not mutually exclusive, connected with a random experiment E. If $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$ and $P(A \cup B) = \frac{1}{2}$, find the values of the following probabilities :

   (a) $P(A \cap B)$, (b) $P(A \cap B^c)$, (c) $P(A^c \cap B^c)$,

   where c stands for the complement. 7

3. There are 64 beds in a garden and 3 seeds of a particular type of flower are sown in each bed. The probability of a flower being white is 1/4. Find the number of beds with 3, 2, 1 and 0 white flowers. 7

4. A random variable X has the following probability distribution :

Value of X	– 2	– 1	0	1	2	3
P (X = x)	0·1	K	0·2	2K	0·3	K

(a) Find the value of K.

(b) Find the expected value and variance of X. 7

5. Solve by Simplex method the following linear programming problem : 7

Maximize $F = x_1 + 2x_2 + x_3$

Subject to

$$2x_1 + x_2 - x_3 \leq 2$$

$$-2x_1 + x_2 - 5x_3 \geq -6$$

$$4x_1 + x_2 + x_3 \leq 6$$

$$x_i \geq 0, \; i = 1, 2, 3$$

6. Solve by steepest descent method the following non-linear programming problem : 7

Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$

starting from the point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$.

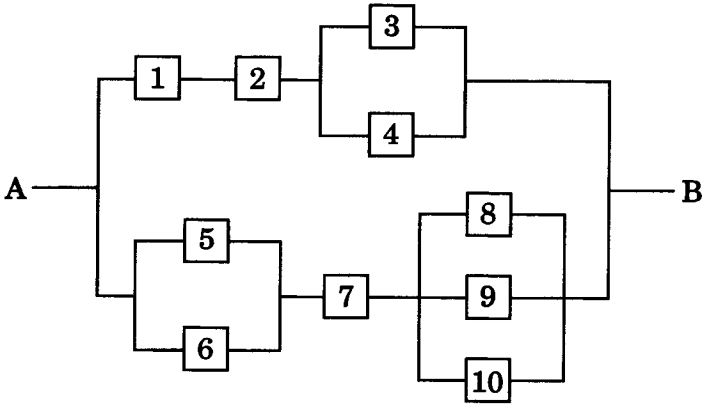
7. What is the difference between quadratic and cubic interpolation methods ? 7

8. Define objective function and objective function surfaces in respect of optimization problem. 7

9. Find the extreme points of the function

$$f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6.$$ 7

10. Derive a general expression for the reliability of the model shown in the following figure and hence evaluate the system reliability if all components have a reliability of 0·8. 7



11. Explain Monte Carlo methods and give a situation where these methods are useful. 7

12. Write the fundamental concept of reliability analysis and discuss the First-Order Second-Moment method. 7