



**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours Part-II Examination, 2020

**COMPUTER SCIENCE**

**PAPER: CMSA-III**

Time Allotted: 2 Hours

Full Marks: 50

*The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.*

**Two marks will be awarded for neatness**

**Answer any *three* of the following questions**

16×3=48

1. (a) Define a circuit matrix B for a graph G. Illustrate with a proper example. List some of the vital observations that can be made about the circuit matrix B(G). 2+4+2
- (b) Prove that a simple graph with  $n$  vertices and  $k$  components can have atmost  $(n-k)(n-k+1)/2$  edges. 3
- (c) State and prove the generalized Pigeonhole Principle. 3+2
  
2. (a) Find the number of primes less than 200 using the principle of Inclusion and Exclusion. 6
- (b) Find the number of subsets (with 10 elements) of the set  $S = \{1,2,\dots,100\}$  that do not contain a pair of consecutive integers. 4
- (c) An unbiased coin is tossed five times. Find the probability of getting more than one head. 4
- (d) State Cook's theorem. 2
  
3. (a) If  $P$  and  $Q$  are two propositions, prove that  $((PVQ) \sim Q) \rightarrow P$  is a tautology. 3
- (b) What is Partition of a set S? Let  $S = \{\text{Red, Green, Blue, Yellow}\}$ . Determine which of the following is a partition of S? 3
  - (i)  $P_1 = [\{\text{Red}\}, \{\text{Green, Blue}\}]$
  - (ii)  $P_2 = [\{\text{Red, Green, Blue, Yellow}\}]$
  - (iii)  $P_3 = [\{\text{Blue}\}, \{\text{Red, Green, Yellow}\}]$
- (c) Let S be the set of all non-negative integers and let  $\rho$  be a binary relation on S defined by  $a\rho b$ , if and only if  $a-b$  is divisible by 5. Prove that  $\rho$  is an equivalence relation on S. Find out the equivalence classes of S defined by  $\rho$ . 5
- (d) What is a bijective function? Let R be the set of real numbers. Let  $f : R \times R \rightarrow R$  be a function defined by  $f(x, y) = (x+y)/(x-y)$ . Verify whether f is a bijective function or not. 5

4. (a) Find out the number of distinguishable arrangements of the word APPLETREE. 3  
 (b) Among 50 students in a class, 26 got an A in the first examination and 21 got an A in the second examination. If 17 students did not get an A in either examination, how many students got A in both examinations? 3  
 (c) State the multiplication theorem for conditional probability. 2  
 (d) Suppose two dice are rolled simultaneously. What is the probability that the sum of the numbers showing on the top faces is **ten**? 3  
 (e) Husband and wife appear for an interview. The probability that husband gets selected is  $1/7$  and wife gets selected is  $1/5$ . What is the probability that (i) only one of them is selected, (ii) both of them are selected and (iii) none of them are selected? 5

5. (a) Solve the following linear programming problem by graphical method: 6  
 Maximize  $Z = 2x + 3y$  subject to

$$x \leq y$$

$$y \leq 3$$

$$3x + 2y \leq 8, \quad x, y \geq 0$$

- (b) Consider the following transportation problem: (5+5)

| Origin | Destination |    |    |    | Availability |
|--------|-------------|----|----|----|--------------|
|        | 1           | 2  | 3  | 4  |              |
| 1      | 5           | 8  | 3  | 6  | 30           |
| 2      | 4           | 5  | 7  | 4  | 50           |
| 3      | 6           | 2  | 4  | 6  | 20           |
| Demand | 30          | 40 | 20 | 10 |              |

- (i) Use an approximation method to find an initial feasible solution.  
 (ii) Test this solution for optimality. If it is not optimal, find out the feasible optimal solution.

6. (a) What is a context-free or type 2 grammar? 3  
 (b) Construct context-free grammars to generate patterns: 4+4  
 (i)  $a^n b^n, n \geq 1$  (ii)  $(ab)^n, n \geq 1$   
 (c) Consider a grammar whose productions are: 5  
 $S \rightarrow aAS \mid a,$   
 $A \rightarrow SbA \mid SS \mid ba$   
 Show that  $S \rightarrow aabbaa$  and construct a derivation tree whose yield is aabbaa.

**N.B. :** Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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