

NJR/KS/18/3209

**Bachelor of Computer Application (B.C.A.) Semester—I (C.B.S.) Examination**  
**DISCRETE MATHEMATICS—I**  
**Paper—IV**

Time : Three Hours]

[Maximum Marks : 50]

**Note :— ALL questions are compulsory and carry equal marks.**

**EITHER**

1. (A) Construct the truth table for  
 $(\neg P \wedge C \neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R)$ . 5
- (B) Prove that If  $H_1, H_2, \dots, H_m$  and  $P$  imply  $Q$ , then  $H_1, H_2, \dots, H_m$  imply  $P \rightarrow Q$ . 5

**OR**

- (C) What do you mean by contradiction statement.  
 Check whether  $((\neg Q \wedge P) \wedge \neg Q)$  is contradiction or not ? 5
- (D) Show that :  
 $(\neg P \wedge (\neg Q \wedge R) \vee (Q \wedge R) \vee (P \wedge R)) \Leftrightarrow R$ . 5

**EITHER**

2. (A) Define :  
  - (i) Disjunctive Normal Form
  - (ii) Conjunctive Normal Form. 5- (B) Obtain the principal disjunctive normal form of  $P \rightarrow ((P \rightarrow Q) \wedge \neg(\neg Q \vee \neg P))$ . 5

**OR**

- (C) Obtain a conjunctive normal form of the following formula :  
 $\neg(P \vee Q) \Leftrightarrow (P \wedge Q)$ . 5
- (D) Show that the formula  $P \vee (P \wedge Q) \Leftrightarrow P$  is equivalence formula. 5

**EITHER**

3. (A) Demonstrate that  $R$  is a valid inference from the premises  $P \rightarrow Q, Q \rightarrow R$  and  $P$ . 5
- (B) Show that the conclusion  $C$  is valid from the premises  $H_1$  and  $H_2$ .  
  - (i)  $H_1 : P \rightarrow Q \quad H_2 : P \quad C : Q$
  - (ii)  $H_1 : \neg P, H_2 : P \vee Q \vdash C : P \wedge Q$ . 5

**OR**

- (C) Show that  $R \rightarrow S$  can be derived from the premises  $P \rightarrow (Q \rightarrow S), \neg R \vee S$  and  $Q$ . 5
- (D) Show that  $R \wedge (P \vee Q)$  is a valid conclusion from the premises  $P \vee Q, Q \rightarrow R, P \rightarrow M$  and  $\neg M$ . 5

**EITHER**

4. (A) Explain Free and Bound variables with suitable example. 5
- (B) Show that  $\neg P(a, b)$  follows logically from  $(x)(y) (P(x,y) \rightarrow W(x,y))$  and  $\neg W(a,b)$ . 5

**OR**

- (C) Prove that :  
 $(\exists x) (P(x) \wedge Q(x)) \Rightarrow (\exists x) P(x) \wedge (\exists x) Q(x).$  5
- (D) Show that :  
 $(x) (P(x) \rightarrow Q(x)) \wedge (x) (Q(x) \rightarrow R(x)) \Rightarrow (x) (P(x) \rightarrow R(x)).$  5
5. Attempt ALL :  
(A) Define conjunction operation and state its truth table. 2½  
(B) What is min-term ? Write down all the min-terms for three variables P, Q and R. 2½  
(C) State the rules of Inferences. 2½  
(D) Explain the rules of US and ES. 2½

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