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F.Y.BCA, Sem II, MAY/JUNE SUPPLEMENTARY EXAMINATION 2018

DISCRETE MATHEMATICS

Duration: 2 Hours **Total Marks: 50**

Instructions:

1. *Figures to the right indicate maximum marks*
2. *All questions are compulsory*

Q .1 Answer the following

a) Answer the following questions **(1X5=5)**

i. Write *converse, inverse and contra-positive* statement of the implication $if x = 4\ then\ x^2 - 16 = 0$

ii. If $f(x) = x^2$, find $f(f(x))$

iii. Draw logic gate diagram for $\bar{x}_1 + x_2$

iv. If A= $\{x\epsilon N|\ 1 < x < 9\}$ and B= $\{x\epsilon N|\ x\ is\ even\ and\ x < 10\}$ Write A−B and B−A

v. $^6C_4 - {}^5C_4$ = ______?

b) Solve the following **(1X5=5)**

i. Convert $(10)_2$ into Decimal number

ii. Convert 0.3125 into Binary number

iii. Convert 56 into Hexadecimal number

iv. Convert 16 into octal number

v. Convert $(AB)_{16}$ into decimal number

Q .2 Answer the following (Any two) **(5X2=10)**

a) Use principle of mathematical induction to prove that

$$\left(1-\frac{1}{2^2}\right)\left(1-\frac{1}{3^2}\right)\left(1-\frac{1}{4^2}\right)\cdots\left(1-\frac{1}{n^2}\right) = \frac{n+1}{2n} \quad , n \geq 2 , n\epsilon\ \mathbf{N}$$

b) Use Binomial theorem to prove that

$$^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \ldots + {}^nC_n = 2^n\ and$$

$$^nC_0 - {}^nC_1 + {}^nC_2 - {}^nC_3 + \ldots + (-1)^n\ {}^nC_n = 0$$

c) Prove that $(p \rightarrow q)$ and $[(\sim p \vee q) \wedge (\sim q \vee p)]$ are not equivalent

Q .3 Answer the following (Any two) (5X2=10)

a) Prove the following by using properties of Boolean algebra

$(x+y)\cdot(x+z)\cdot\overline{(\bar{x}\cdot y)}=x$

b) Use basic logic gates to draw logic diagram for the following

NAND, NOR, XOR, $(x_1+\bar{x}_2)*\bar{x}_1$, $(\bar{x}_1+\bar{x}_2)*(\bar{x}_2)$

c) Write the definitions of the following in set builder form

i. Union of two sets
ii. Intersection of two sets
iii. Complement of a set
iv. Difference of two sets
v. Cartesian product

Q .4 **Answer the following (Any two)** **(5X2=10)**

a) If U $=\{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15\}$, **U** is a universal set and A=$\{2,3,5,7,11,13\}$ and B= $\{2,4,6,8,10,12,14\}$, then prove that

i. $\overline{(A\cup B)}=\bar{A}\cap\bar{B}$
ii. $\overline{(A\cap B)}=\bar{A}\cup\bar{B}$
iii. $A-B=A\cap\bar{B}$

b) There are 6 boys and 6 girls in a committee. A group of 4 should be sent abroad for a presentation. In how many ways can this be done if

i. There should be equal number of boys and girls
ii. The group consists of atmost 4 girls
iii. Exactly 4 boys
iv. Atleast 3 girls should be there in the group
v. No restriction on the number of boys and girls

c) Justify why the following relations defined on A = {1,2,3,4,5,6} are not Equivalence relations

i. $R_1=\{(1,1),(2,2),(4,4),(5,5),(6,6)\}$
ii. $R_2=\{(a,b)|\ a\le b\}$
iii. $R_3=\{(a,b)|\ a+b=2\}$
iv. $R_4=\{(a,b)|\ a^2=b\}$
v. $R_5=\{(1,2),(2,3),(1,3)\}$

Q .5 **Answer the following (Any two)** **(5X2=10)**

a) Draw the graph of Greatest Integer Function. Consider the functions f,g: **N** $\longrightarrow$ **N** defined by $f(x)=2x\ and\ g(x)=2x-1$ prove that both $f\ and\ g$ are one-one, but both are not onto

b) Define equivalence relation. Prove that the relation R= $\{(a,b)|\ \ a-b\ is\ divisible\ by\ 7\}$ defined on **N** is an Equivalence relation

c) Find the languages L(G) generated by the grammar with V=$\{S,A,B\}$;p= $\{x,y\}$ and P= $\{S\longrightarrow xB, B\rightarrow y, B\rightarrow yA, A\rightarrow xB\}$

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