B. N. BANDODKAR COLLEGE OF SCIENCE, THANE

S.Y.B.SC. (INFORMATION TECHNOLOGY) SEMESTER – III EXAMINATION; OCTOBER 2014

COURSE CODE– USIT301

Duration: 2½ Hrs **Total Marks: 75**

N.B. 1. All questions are compulsory.

Q. 1 **Answer *any two* out of following** **10**

a Let U={a,b,c,d,e.f,g,h,k}, A={a,b,c,g}, B={d,e,f,g}, C={a,c,f} and D={f,h,k}. Compute
(a) AUB (b) BUC (c) (AUB)-C (d) (AUB)-(CUB) (e)AUBUC

b Among 100 students ,55 students got distinction in first year, 30 got distinction in second year,15 got distinction in both years. Then how many students got distinction in at least one year.

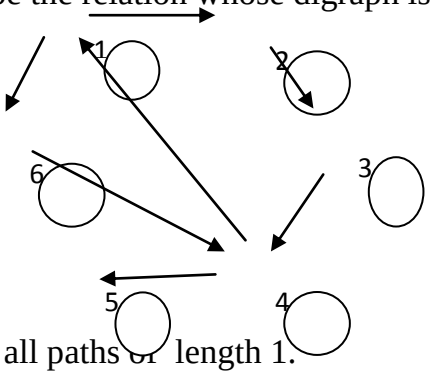
c Suppose that 100 people surveyed and it is found that 78 like oranges, 47 like mangoes and 10 like neither. How many like both? How many like oranges but not mangoes?

d Show by mathematical induction, that for all n>=1; 5+10+15+……..+5n = 5n(n+1)/2

Q. 2 **Answer *any two* out of following** **10**

a Construct the digraph of the relation R={(1,1),(1,3),(2,1),(2,3),(2,4).(3,1),(3,2),(4,1)}on the set {1,2,3,4} and find in-degree and out-degree of digraph, matrix M_R and find symmetric closure.

b Let R be the relation whose digraph is given then answer the following questions:



(a)List all paths of length 1. (b) List all paths of length 2.
(c) Find a cycle starting at vertex 2. (d)Find a cycle starting at vertex 6.
(d)Find M_R.

c Explain all properties of relation with one example.

d Let A={ 1,2,3,4 } and let R={ (1,2) , (2,3), (3,4),(2,1)} Find the transitive closure using Warshall's algorithm.

Q. 3 **Answer *any two* out of following** **10**

a Let f be the mod-10 function. Compute
(a) f(417) (b) f (38) (c) f (253) (d) f (81) (e) f(316)

b Compute each of the following:
(a) Floor function of -17.3. (b) Ceiling function of 3.67.
(c) $Log_2(512)$ (d) $Log_2(64)$ (e) Ceiling function of -4

c Show that if 30 dictionaries in a library contain a total of 61,327 pages , then one of the

dictionaries must have at least 2045 pages.

d Let A=B=C=Real numbers and let f:A→B, g:B→C be defined by f(a)=a-1 and $g(b)=b^2$ Find

(a) (fog)(2) (b) (gof)(x) (c) (fof)(y)

(d) (gof)(-2) (e) (gog)(y)

Q. 4 Answer *any two* out of following **10**

a Construct the tree of following algebraic expression. Also find PREORDER, POSTORDER, INORDER and give Doubly linked list representation of the tree.

(x + (y - (x + y))) * ((3 / (2*7)) * 4)

b Explain all the the types of graph with one example.

P.T.O.

c Let G be a connected planer graph then prove the Euler's formula |V|+|R|-|E|=2 using mathematical induction.

d What is polish form ?Evaluate the expression given in reverse polish form :

a) + - ^ 3 2 ^ 2 3 / 8 – 4 2

b) + - * 2 3 5 / ^ 2 3 8

Q. 5 Answer *any two* out of following **10**

a Prepare a table for addition mod 15 for the set G={0,3,6,9,12}. Determine whether G under this binary operation is a group.

b Define following:

i) Semigroup ii) Monoid iii) Group

iv) Abelian group v) Order of group

c Show that an (2,4) encoding function $e:B^2 \rightarrow B^2$ defined by e(00)=0000, e(0)=0011, e(10)=1101, e(11)=1110 is a group code.

d Show that set G={1,2,3,4,5}is not a group under addition & multiplication modulo 6.

Q. 6 Answer *any two* out of following **10**

a Let c_1 & c_2 be real numbers. Suppose that $r^2-c_1r-c_2=0$ has two distinct roots r_1 & r_2. Then prove that the sequence { a_n } is a solution of the recurrence relation $\mathbf{a_n=c_1a_{n-1}+c_2a_{n-2}}$ if and only if $\mathbf{a_n=\alpha_1 r_1^n + \alpha_2 r_2^n}$ for n=0,1,2,3,4....where α_1 and α_2 are constants

b Determine whether the sequence $\{a_n\}$ is a solution of the recurrence relation $a_n=2a_{n-1}-a_{n-2}$ for n=2,3,4,….where $a_n=3n$ for every nonnegative integer n. answer the same question where $a_n=2^n$ and where $a_n=5$.

c What is Recurrence relation?

Show that the sequence $\{a_n\}$ is a solution of the recurrence relation : $\mathbf{a_n = 8a_{n-1} - 16a_{n-2}}$

i. $a_n= n4^n$

ii. $a_n=2.4^n + 3n4^n$

d Define recurrence relation. Find the first five terms of the sequence of the following recurrence relations and initial conditions.

(1) $a_n = 3a_{n-1}$, $a_0=2$

(2) $a_n= a_{n-1}+ 2a_{n-2}$, $a_0=1$, $a_1=2$

Q. 7 Answer *any three* out of following **15**

a Define the following terms along with Venn diagram.

a) Union

b) Intersection
c) Disjoint sets
d) Complement of B with respect to A.
e) Symmetric difference

b Let A={1,2,3,4} and R={(2,1),(2,3),(3,2),(3,3),(2,2),(4,2)}.
(a)Find the reflexive closure of R, matrix and also draw digraph.
(b)Find the symmetric closure of R, matrix and also draw digraph.

c What is extended Pigeonhole Principle? Show that if 7 colors are used to paint 50 bicycles at least 8 bicycles will be of the same color.

d Evaluate the expression given in Polish form.

c) / - 7 5 + * 3 2 4
d) / - * / + - 8 2 9 3 5 5 5
e) + - ^ 3 2 ^ 2 3 / 8 – 4 2
f) + - * 2 3 5 / ^ 2 3 8
g) + / 4 2 * 6 - 1 3

e Show by mathematical induction, that for all n>=1,
$1^2+3^2+5^2+\ldots\ldots\ldots+(2n-1)^2=n(2n+1)(2n-1)/3$

f Find the first six terms of the sequence (a_0, a_1, a_2, a_3, a_4, a_5, a_6) defined by following recurrence relation and initial condition: $\mathbf{a_n = a_{n-1} + 3\, a_{n-2}}$**, $\mathbf{a_0=1}$, $\mathbf{a_1=2}$**

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