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MCS-033

MCA (Revised)

Term-End Examination

07545 **December, 2016**

MCS-033 : ADVANCED DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question no. 1 is* ***compulsory****. Attempt any* ***three*** *questions from the rest.*

1. (a) Using induction, show that

$T_n = 2^n - 1$, where $n \geq 1$,

where $T_n = 2T_{n-1} + 1$. *5*

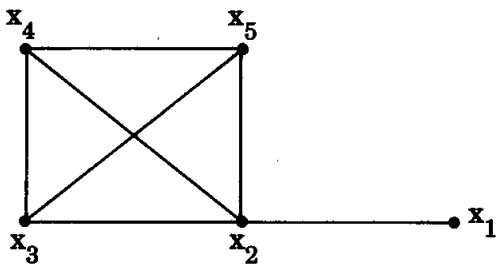
(b) Prove that the complement of $\overline{G}$ is G. *5*

(c) Draw at least 3 non-isomorphic graphs on 4 vertices. *5*

(d) Prove that $a_n = \frac{3n}{2} - 2$ is a solution to the recurrence $a_n = 2a_{n/2} + 2$, where n is a power of 2 and $a_2 = 1$. *5*

2. (a) Find the number of bijections on a set of n elements, where $n \geq 1$. 5

(b) Consider the graph on 5 vertices and 7 edges given in the figure. Find x_1 to x_5 walks of length 8 and length 4 respectively. 5



3. (a) If G is a graph with n vertices and k components, then prove that G can have at least $n - k$ edges and at most $\left\{\frac{(n-k)(n-k+1)}{2}\right\}$ edges. 5

(b) Solve the third order recurrence

$U_n - 9U_{n-1} + 26U_{n-2} - 24U_{n-3} = 0,$

where $n \geq 3$, with the initial conditions

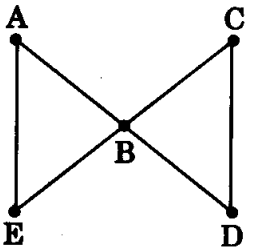
$U_0 = 6$, $U_1 = 17$ and $U_2 = 53$. 5

4. (a) Solve the recurrence

$d_k = k\, d_{k-1} + (-1)^k$ if $k \geq 2$ with $d_1 = 0$. 5

(b) Find λ (G), where G is the Petersen graph. 5

5. (a) Draw three spanning trees of the following graph : 3



(b) What is the difference between an Eulerian graph and an Eulerian circuit ? 2

(c) Construct a graph with chromatic number 5. 3

(d) Solve the recurrence relation $a_n = a_{n/2} + 1$ for $n = 2^k$, where $k \geq 1$, $a_1 = 0$. 2