MCS-033

MCA (Revised)
Term-End Examination
December, 2014

08734

## MCS-033 : ADVANCED DISCRETE MATHEMATICS

Time : 2 hours   *Maximum Marks : 50*

Note : *Question number* **1** *is* **compulsory***. Attempt any* **three** *questions from the rest.*

1. (a) Differentiate methods of 'inspection' and 'telescoping sums' on relevant attributes. Cite an example application for each.   *4*

   (b) Explain the Tower of Hanoi problem with an example.   *4*

   (c) Suppose that the sequence $\{a_n\}$ $n \geq 0$, has the generating function $A(z)$. Then, the generating function $B(z)$ for the sequence $\{b_n\}$ $n \geq 0$, where $b_n = a_n - a_{n-1}$ for $n \geq 1$, and $b_0 = a_0$, is given by $\dfrac{B(z)}{A(z)} = (1 - z)$.   *4*

   (d) State and prove Handshaking theorem.   *4*

(e) Find the chromatic number of the following graph : 4
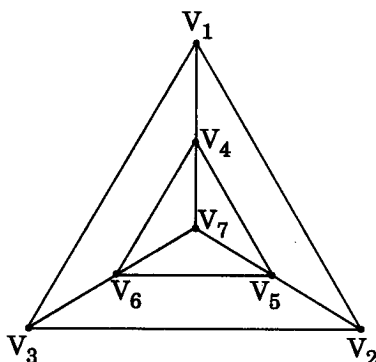
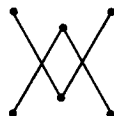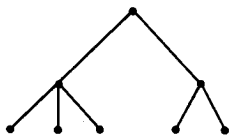2. (a) Show that K_5 is not planar. 5

(b) Which of the following graphs are trees, and why ? 5
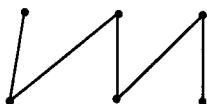
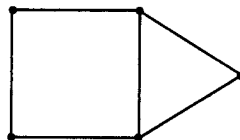(a)   (b)

(c)   (d)

3. (a) Show that for a sub-graph H of a Graph G, $\Delta H \leq \Delta G$. 5

(b) Solve the recurrence relation

$u_n = 2 u_{n-1} + 2^n - 1$ where $n \geq 1$ and

$u_0 = 0$. 5

4. (a) Evaluate the sum $\displaystyle\sum_{k=1}^{n} k \, 3^k \, C(n, k)$, using generating function technique. *5*

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

5. (a) Solve the third order recurrence $u_n - 9\, u_{n-1} + 26\, u_{n-2} - 24\, u_{n-3} = 0$, where $n \geq 3$ with the initial conditions $u_0 = 6$, $u_1 = 17$ and $u_2 = 53$. *5*

(b) Anil takes a loan of r rupees which is to be paid back in t months. If i is the interest rate per month for the loan, what constant payment p must he make at the end of each period ? *5*