



RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES, MIHINTALE

B. Sc. (Industrial Mathematics) Degree
Fourth Year – Semester I Examination – April/May 2015
MAT 4309 – Combinatorics

Answer All Questions

Time allowed: Two hours

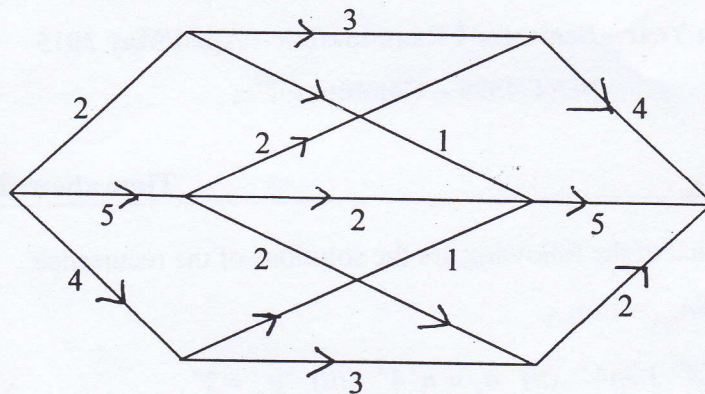
1. (a) Determine which of the following are the solutions of the recurrence relation $a_n = 8a_{n-1} - 16a_{n-2}$.
(i) $a_n = 2 \cdot 4^n + 3n4^n$ (ii) $a_n = n^2 4^n$ (iii) $a_n = 2^n$.
(b) Find the solution of recurrence relation
 $a_n = 7a_{n-2} + 6a_{n-3}, \quad a_0 = 9, a_1 = 10, a_2 = 32$.
(c) Find a recurrence relation for the number of bit strings of the length n that do not contain three consecutive 0 s. What are the initial conditions?
How many bit strings are of length seven that do not contain three consecutive 0 s?
2. (a) Using *Generating Functions*, solve the recurrence relation $a_n = 3a_{n-1}$ where $a_0 = 2$.
(b) State the Exclusion and Inclusion principle.
(i) How many integers not exceeding 1000 are divisible by 7 or 11?
(ii) Find the number of primes not exceeding 100.
(c) A survey of households in the United States reveals that 96% have at least one television, 98% have telephones and 95% have telephones and at least one television.
What percentage of households in the United States have neither a telephone nor a television?
3. Define STS(n), a Steiner Triple System of order n .
(a) Construct STS(7).
(b) Construct a tournament schedule for *eight* teams.
(c) Using above (a) and (b) construct STS(15).

[P.T.O.]

4. Define each of the following terms: *a Walk*, *a Trial*, *a Path* and *a Cycle*.
State the Maximum Flow and Minimum Cut Theorem.

Find the Maximum Flow and Minimum Cut of the following networks.
Hence, verify the above theorem.

(i)



(ii)

