COMP2201 – Discrete Mathematics
Matching

1. A small school has five teachers, Andy, Beth, Charl, Donnue and Eve. In the spring term, six courses, CS1, CS2, CS3, CS4, CS5 and CS6, are to be offered. Each teacher is qualified to teach one or more courses. The school has the following information for each teacher.

Teacher	**Courses qualified for**
Andy	CS1, CS5, CS6
Beth	CS2, CS4
Charl	CS1, CS2, CS3
Donnue	CS3, CS4
Eve	CS2, CS6

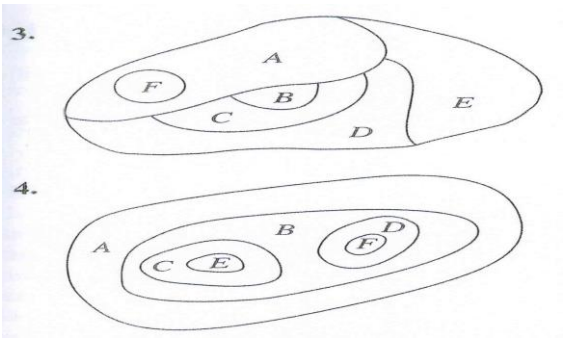
   i. Model the above situation as a matching network
   ii. Find a maximal matching
   iii. Find a way in which each teacher can be assigned to teach a course or use Hall's Theorem to explain why no such way exists.

2. Applicant A is qualified for jobs J_1, J_2, J_4 and J_5; B is qualified for jobs J_1, J_4 and J_5; C is qualified for jobs J_1, J_4 and J_5; D is qualified for jobs J_1 and J_5. E is qualified for jobs J_2, J_3 and J_5; F is qualified for jobs J_4 and J_5.

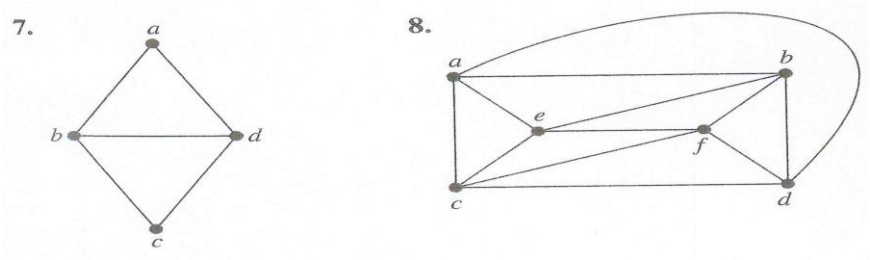
   Model the above situation as a matching network
   Find a maximal matching
   Show a complete matching or Use Hall's Theorem to show that one does not exist.

Colouring

3. Construct the Dual Graph, G and determine the chromatic number of G, $\chi(G)$ in exercises 3.3 to 3.4



4. Find the chromatic number of the given graphs in exercises 4.7 to 4.8



5. Given courses 1 to 7 and the listing which shows cou3rses for which exams cannot be at the same time due to student schedules, construct the graph representing the scheduling of final exams and by using coloring, schedule the final exams and thereby determine the minimum number of time periods necessary for the seven courses.

Students who pursue Course 1 also pursue Courses 2, 3, 4 and 7.
Those who pursue Course 2 also pursue Courses 3, 4, 5 and 7.
Students who pursue Course 3 also pursue 1, 4, 6 and 7.
Those who pursue Course 4 also pursue Courses 2, 3, 5 and 6.
Students who pursue Course 5 also pursue Courses 6 and 7.
Those who pursue Course 7 also pursue Courses 1, 2 and 6.

Trees

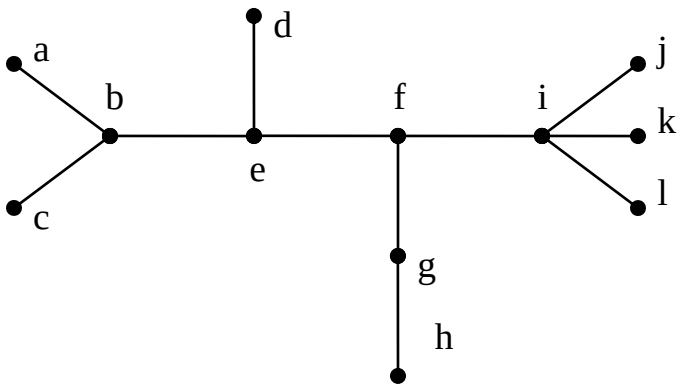
6. Represent the following expression as a binary tree and write the prefix and postfix forms of the expression.

(((A + B) * C + D) * E) – ((A + B) * C – D)

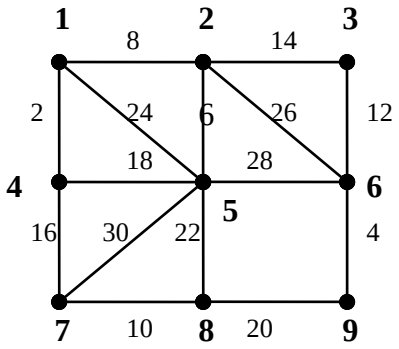
7. Represent the postfix expression as a binary tree and write the prefix form, the usual infix form, and the fully parenthesized infix form of the expression.

A B C * * C D E + / -

8. Draw the free tree of the graph below as a rooted tree with root f.



9. Find a minimal spanning tree for the following graph.



10. For the following binary tree, list the order in which the vertices are processed using preorder, inorder and postorder traversal.