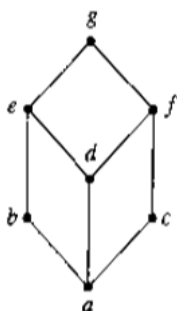


# Discrete Mathematics — Final Examination (Paper B)

考试 注意 事项	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。 二、书本、参考资料、书包等与考试无关的东西一律放到考场指定位置。 三、学生不得另行携带、使用稿纸，要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。 四、学生必须将答题内容做在试题答卷上，做在草稿纸上一律无效。												
考试课程	离散数学												
题号	一	二	三	四	五	六	七	八	九	十			总分
满分	10	10	10	14	6	10	10	10	10	10			
得分													
阅卷教师													

- [10 points] Suppose  $A = \{a, b, c, d, e\}$ . Let  $R$  and  $S$  be the relations on  $A$  described by  $R = \{(a, c), (b, c), (c, e), (d, a), (d, b), (e, c)\}$  and  $S = \{(a, b), (a, c), (c, d), (d, e), (e, a)\}$ . Use Warshall's algorithm to compute the transitive closure of  $S \circ R$ .
- [10 points] Answer these questions for the partial order represented by this Hasse diagram.



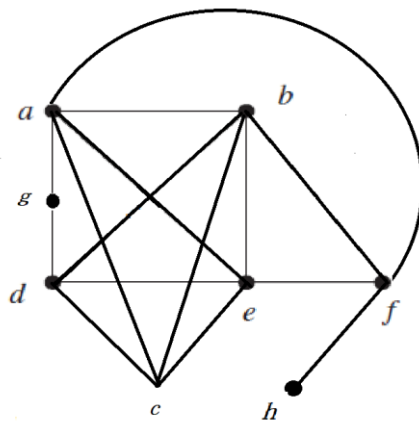
- Compute  $\text{LUB}(\{b, c\})$ .
  - Compute  $\text{GLB}(\{f, b\})$ .
  - Is the poset a lattice? Explain your answer.
- [10 points] Prove that if  $(G, *)$  and  $(G', *)'$  are Abelian groups, then  $(G \times G', *)''$  is an Abelian Group.

4. [14 points] Let  $m=3$ ,  $n=6$ ,  $H = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  be a parity check matrix

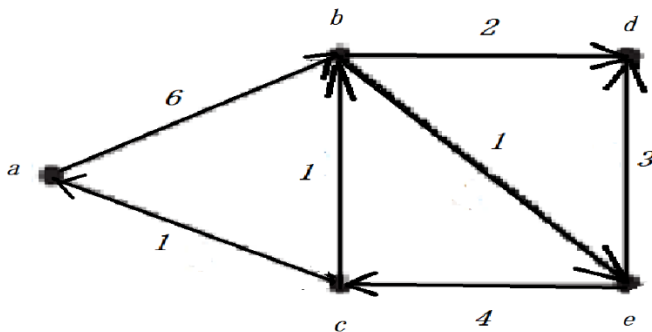
- Determine the  $(3, 6)$  group code  $e_H: B^3 \rightarrow B^6$ .
- Find the minimal distance of  $e_H$ .
- How many errors will  $e_H$  detect?
- Decode the following words relative to a maximum likelihood decoding function associated with  $e_H$ .

(1) 101011      (2) 111011      (3) 000111

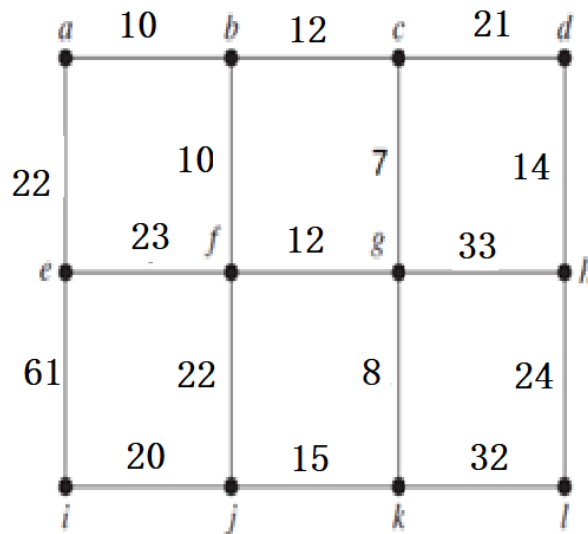
5. [6 points] Determine whether the given graphs have an Euler circuit or a Hamilton circuit. If not, determine whether the given graphs have an Euler path or a Hamilton path. And determine whether the given graphs are planar.



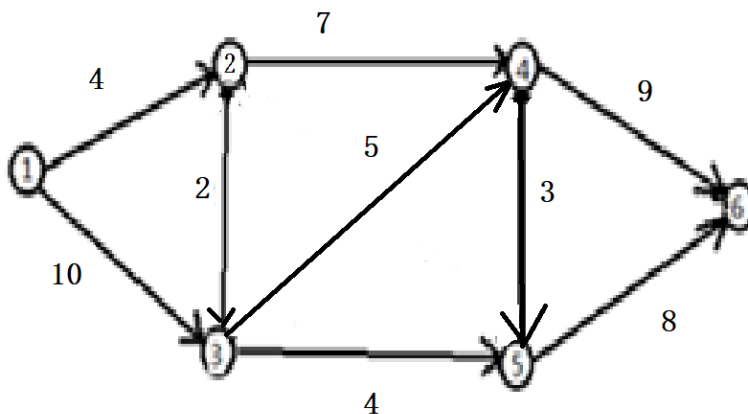
6. [10 points] Finding the shortest path length between any two vertices using distance matrix.



7. [10 points] Use Kruskal's algorithm to design a minimum-cost communications network connecting all the computers represented by the graph in next Figure.



8. [10 points] Find a maximum flow in the given network by using the labeling algorithm. And find a minimum cut of this network. (Please give out the labeling graph of every flow.)



9. [10 points] Find the solution to the recurrence relations  

$$a_n = 5a_{n-1} - 4a_{n-2}, a_0 = 1, a_1 = 9.$$
10. [10 points] Set up a generating function and use it to find the number of ways in which eleven identical coins can be put in three distinct envelopes (labeled A, B, C) if envelope A has at least three coins in it.