

CPSC 320 Midterm 2

July 14, 2006

Name: _____ Student ID: _____

Signature: _____

- You have $1\frac{1}{2}$ hour to write the 6 questions on this examination. A total of 30 marks are available.
- *Justify all of your answers.*
- You are allowed to bring in one double-sided letter size sheet of paper and nothing else.
- Keep your answers short. If you run out of space for a question, you have written too much.
- The number in the square brackets next to the question number is the # of marks allocated for that question. Use these to help determine how much time you should spend on each question.
- Use the back of the pages for your rough work.
- *Good luck!*

Question	Marks
1	
2	
3	
4	
5	
6	
Total	

UNIVERSITY REGULATIONS:

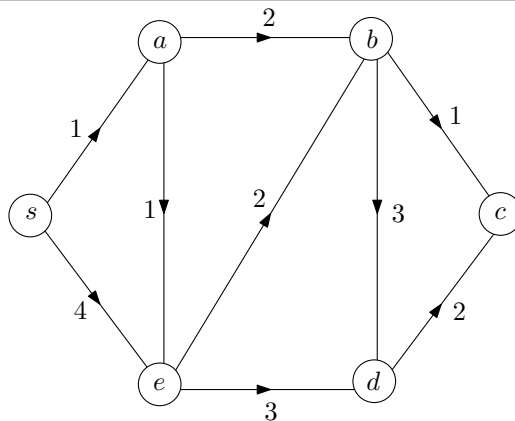
- Each candidate should be prepared to produce, upon request, his/her library card.
- No candidate shall be permitted to enter the examination room after the expiration of one half hour or to leave during the first half hour of the examination.
- **CAUTION:** candidates guilty of any of the following, or similar, dishonest practices shall be immediately dismissed from the examination and shall be liable to disciplinary action.
 1. Having at the place or writing, or making use of, any books, papers or memoranda, electronic equipment, or other memory aid or communication devices, other than those authorized by the examiners.
 2. Speaking or communicating with other candidates.
 3. Purposely exposing written papers to the view of other candidates. The plea of accident or forgetfulness shall not be received.
- Candidates must not destroy or mutilate any examination material; must hand in all examination papers; and must not take any examination material from the examination room without permission of the invigilator.

1. [5] You have a set $\{[a_1, b_1], [a_2, b_2], \dots, [a_n, b_n]\}$ of n activities to schedule between two people. Each person cannot do two activities that overlap and each activity is done at most once. Your friend says that you can maximize the total number of activities performed

- (a) running the greedy ActivitySelection algorithm once for the first person and
- (b) running the algorithm again on the remaining unscheduled activities for the second person.

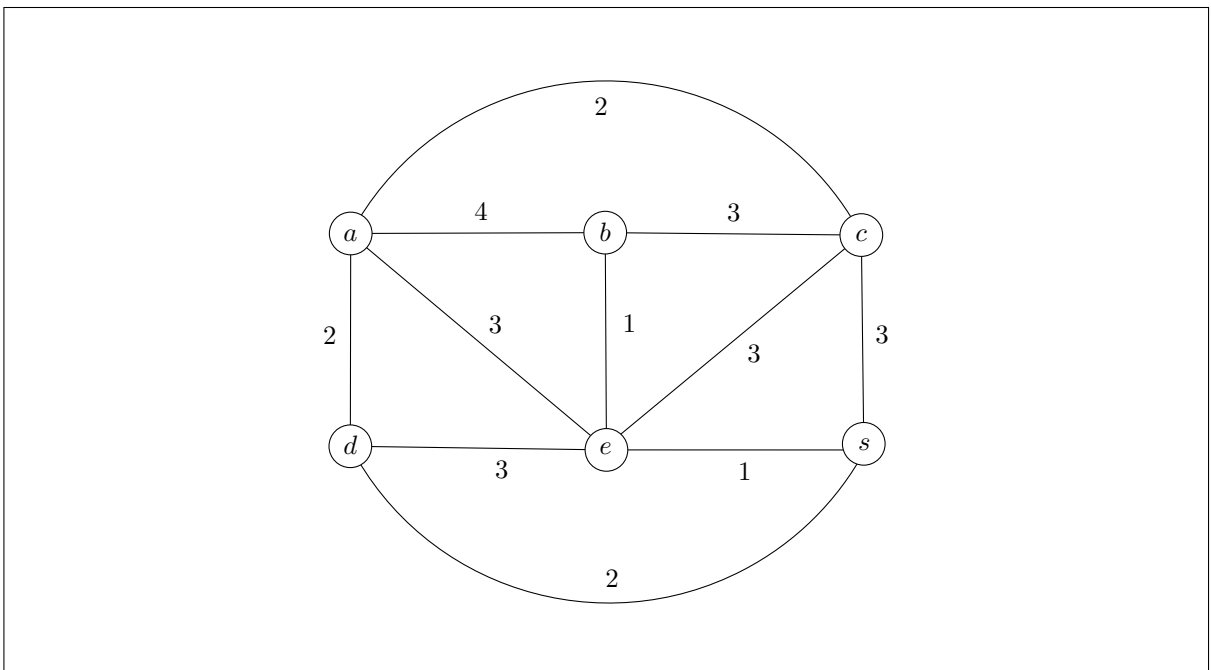
Give a set of activities on which this algorithm does not give an optimal solution. Please be concrete (i.e. use numbers or, better yet, draw a picture).

2. [5] Shade the edges of the shortest path tree rooted at the source s found by Dijkstra's algorithm on the following weighted directed graph. List the vertices in the order that they are added to the tree.



3. [5] The midterm marks will be integers in the range of $0 \dots 30$. One way to efficiently find the median is to use one of the divide-and-conquer algorithms in class; in particular, `DeterministicSelect` can find the median in $O(n)$ time in the worst case, where n is the number of exams that were marked. Design an iterative algorithm that fills in a table to solve this problem without recursion with the same $O(n)$ runtime complexity.

4. [5] Run Prim's algorithm starting with vertex s to find the minimum spanning tree of the following weighted undirected graph. Shade the edges in the minimum spanning tree and list the vertices in the order that they are added to the tree.



5. [7] You are given an sequence of activities $\{[a_1, b_1], [a_2, b_2], \dots, [a_n, b_n]\}$ to schedule (e.g. tennis, lunch with a friend) plus a midterm review session $[\alpha, \beta]$ that you just cannot miss.
- (a) [5] Describe an efficient algorithm to schedule the exam review session and as many other activities as possible. You are allowed to use any algorithm described in class as a subroutine. Give an asymptotic upperbound on algorithm's runtime complexity?

- (b) [2] Why is it correct?

6. [3] You are given a weighted undirected graph and to find a spanning tree with *maximum* total weight.
- (a) [1] Describe a modification to Prim's algorithm that solves this problem.

- (b) [2] Why is it correct?