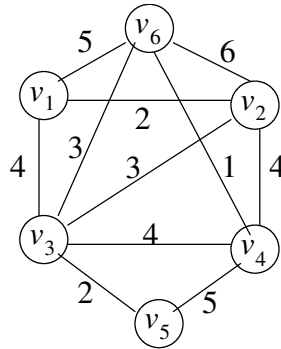


Homework #3 for Algorithms

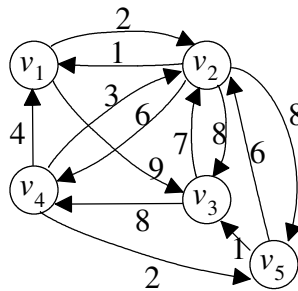
Due: Tuesday, Oct. 25 by 5 PM

Chapter 4: Greedy

1) Use Prim's algorithm to find a minimum spanning tree for the following graph. Show the steps as was done on the class handout.



2) Complete the trace of Dijkstra's Algorithm (Algorithm 4.3) algorithm for the following graph. Show the steps by updating the length and touch arrays as was done in class.



3) **Write a program** using the greedy approach to solve the Traveling Salesperson problem. (Your program will not always find the minimum-length tour.) Run your program on the above graph for problem 2, and hand in the output showing the tour found.

Chapter 5. Backtracking

4) Consider the following 0-1 Knapsack problem with four items and a knapsack weight limit of $W=13$ oz.

| Item | Weight | Value | Value/Weight |
|------|--------|-------|--------------|
| 1 | 4 oz. | \$40 | \$10/oz. |
| 2 | 7 oz. | \$42 | \$6/oz. |
| 3 | 10 oz. | \$50 | \$5/oz. |
| 4 | 3 oz. | \$12 | \$4/oz. |
| 5 | 3 oz. | \$9 | \$3/oz. |

a) Complete the backtracking state-space tree. Use a bound (e.g., best possible solution we could hope to achieve in the subtree) calculation of like we did in class of:

bound of a node = value in knapsack + fractional knapsack problem on remaining items

5) **Write a program** using Backtracking to solve the Traveling Salesperson problem. (Your program should always find the minimum-length tour.) Run your program on the above graph for problem 2, and hand in the output showing the tour found. Use a greedy algorithm to calculate if a node is NOT promising so pruning can be performed.

Submit your homework electronically at https://www.cs.uni.edu/~schafer/submit/which_course.cgi

The steps for the homework submission system are:

1. Write, debug, and test your program in the hw3 folder. When you are ready to submit your homework, zip the whole folder by right-clicking on it and selecting `Send to | Compressed (zipped) folder`. This will create a new file called `hw3.zip` which you will submit electronically.
2. Log on to the submission system at: https://www.cs.uni.edu/~schafer/submit/which_course.cgi

(It is very likely that you will get some security certificate warnings when trying to use this. You may add an exception and accept the existing security certificate.) Use the same AD-ITS User name and password you use to log on the lab computers.
3. Select the course and section number of "CS 6500, Algorithms, Fienup". Click the "Continue".
4. Select the homework that you wish to submit: "HW 3: Greedy and Backtracking Problems". Click the "Continue" button.
5. Specify how many extra files you want to submit. Just leave it at 0. Click the "Continue" button.
6. Upload your program by Browsing and selecting your `hw3.zip` file. Click the "Continue" button.
7. The next page reports on the status of the upload(s). You can always continue to upload a better version of the program until the deadline. The newer file will replace an older file of the same name.