

CS 1200 FS18 HW 07

Due Wednesday 12/05/18 at 11:59 PM

Please submit two files to Canvas (one is a PDF file and the other is the code .py file) :

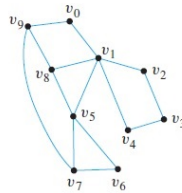
1. A PDF file that contains all the answers to the individual questions, all pictures, all code, and all code output. This should all be well-organized. Points will be deducted for sloppy or disorganized work.
2. All the Python codes (.py file) (You may put all codes in one .py file).

If you need a program that helps you put PDF files together into a single PDF file, try <http://www.pdfsam.org/>. The program there is open source and available for free.

Note: Partial credit will be given on every problem.

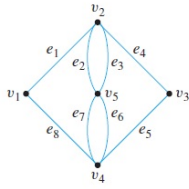
HW7 Problems:

1. (20 pts) In each of the following problems, either draw a graph with the specified properties or explain why no such graph exists.
 - (a) Graph with five vertices of degrees 1,2,2, 3 and 5.
 - (b) Graph with four vertices of degrees 1,2,3 and 4.
 - (c) Full binary tree with seven vertices.
 - (d) Graph with six vertices and five edges is not a tree.
2. (20pts) Euler circuit and Hamiltonian circuit:
 - (a) Given the following graph: Determine whether the graph has Euler circuits. If the

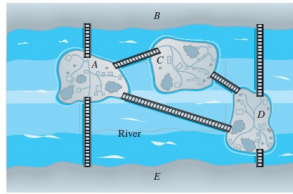


graph does not have an Euler circuit, explain why not. If it does have an Euler circuit, describe it by listing the vertices in order.

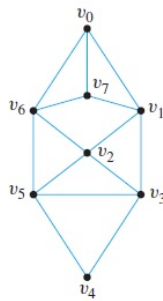
- (b) Determine whether the following graph have Euler circuits. If the graph does not have an Euler circuit, explain why not. If it does have an Euler circuit, describe it by listing the vertices in order.



- (c) Is it possible to take a walk around the city whose map is shown below, starting and ending at the same point and crossing each bridge exactly once? If so, how can this be done? (List the locations in order of the walk.)

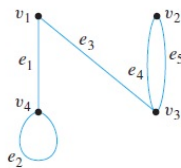


- (d) Find a Hamiltonian circuit for the following graph by listing the vertices in order.



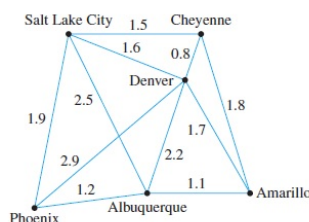
3. (16pts) Answer the following questions:

- In a group of 27 people, is it possible for each to shake hands with exactly 3 other people? Explain.
- Given a binary tree with forty terminal vertices (leaves), what is the minimum value of height?
- Given the following graph:



- i. Find adjacency matrices.
- ii. How many distinct walks of length 2 are there from v_2 to v_3 .

4. (10pts) A pipeline is to be built that will link six cities. The cost (in hundreds of millions of dollars) of constructing each potential link depends on distance and terrain and is shown in the weighted graph below. Find a system of pipelines to connect all the cities and yet minimize the total cost by using Kruskal's algorithm (Show the work step by step).



5. (12pts) Answer the following questions:
- If any seven digits could be used to form a telephone number, how many seven-digit telephone numbers would not have any repeated digits?
 - How many seven-digit telephone numbers would have at least one repeated digit?
 - What is the probability that a randomly chosen seven-digit telephone number would have at least one repeated digit?
6. (12pts) Suppose that in a certain state, all automobile license plates have four upper case letters followed by three digits.
- How many license plates could begin with M and end in 0?
 - How many license plates are possible in which all the letters and digits are distinct?
 - How many license plates could begin with MO and have all letters and digits distinct?
7. (10pts) A club is considering changing its bylaws. In an initial straw vote on the issue, 24 of the 40 members of the club favored the change and 16 did not. A committee of six is to be chosen from the 40 club members to devote further study to the issue.
- How many committees of six can be formed from the club membership?
 - How many of the committees will contain at least three club members who, in the preliminary survey, favored the change in the bylaws?
8. (Extra Credit 5pts) Write a program to calculate the binomial coefficients recursively by the following formula

$$C(n+1, k) = C(n, k-1) + C(n, k)$$

and describe what happens when you run it for $C(13, 5)$.