1501 Final Practice Questions

Name: _____

Pitt username (e.g., abc123): _____

Peoplesoft number: _____

Score: _____ / 42

- The use of any notes or electronic devices will be considered cheating.
- You must turn in ALL pages of the exam for your exam to be graded. Failure to turn in all pages of this exam booklet will result in a 0 on the exam .
- Illegible answers will receive 0 points.

1. (4 points) Carefully read each prompt and select the best answer for each question.

   i. Which algorithm can compute the MST of a graph using a standard heap and no other secondary data structures?

   A Kruskal's
   B Eager Prim's
   C Dijkstra's
   D Lazy Prim's

   ii. Which of the following is **not** true of dynamic programming?

   A It uses memoization
   B It is used to solve problems that satisfy the *greedy choice* property
   C It solves problems bottom-up rather than using recursion
   D It is used to solve problems that satisfy the *optimal substructure* property

2. (8 points) Consider the alphabet R, S, T, U, represented by the 2-bit block codes $0, 1, 2, 3$, respectively. Expand the LZW-compressed string represented by the following sequence of (4-bit) codewords:

```
0 3 1 2 2 3 2 7 5 12 6 2 4
```

For each codeword processed, show the output character(s) and the new codeword added to the codebook.

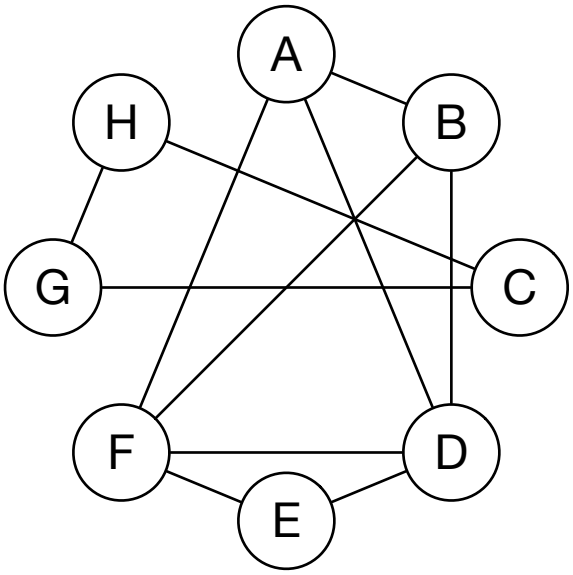
3. (8 points) Consider the change making problem using a currency that has 3 denominations: 1 cent coins, 4 cent coins, and 6 cent coins. Populate the following memoization data structure to determine the minimum number of coins needed to make up 13 cents of change.

C =

0	1	2	3	4	5	6	7	8	9	10	11	12	13

Explain how you calculated the value for cell 13, including which values you considered.

4. (8 points) Use BFS to determine whether the following graph is connected. Start from vertex A, and assume neighbors are seen in alphabetical order.



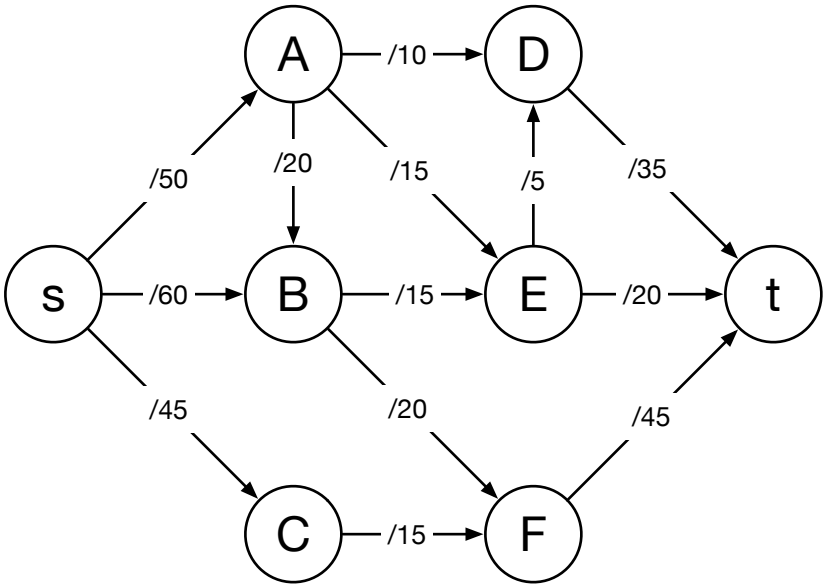
(a) List the vertices that are visited and the order in which they are visited.

(b) Is the graph connected?

(c) What is the runtime of this BFS algorithm if the graph is represented as an adjacency list?

(d) What is the runtime of this BFS algorithm if the graph is represented as an adjacency matrix?

5. (14 points) Use Edmonds-Karp to find a min s, t-cut of the following graph. Assume neighbors are seen in alphabetical order.



(a) List the augmenting paths that you find and the order in which you find them. For each, state by how much the flow is increased.

(b) State the size of a min s, t-cut and give a set of edges that comprises a min s, t-cut.