Test 2

Started: Oct 28 at 6pm

Quiz Instructions

Only answer 2 of the last 3 questions.

You have from 6:00pm to 7:15pm on October 28th to complete the test. Any work you wish to be graded needs to be uploaded through webcourses by 7:45pm.

Question 1

5 pts

What algorithm paradigm fits the Ford-Fulkerson Algorithm?

Question 2

5 pts

What algorithm paradigm discussed in class fits the sudoku solver?

Question 3

5 pts

What algorithm paradigm fits a method that tries all permutation of nodes for finding the shortest path that visits all nodes?

Question 4

5 pts

What is the worst case runtime of the BFS algorithm on a graph with |V| nodes and |E| edges?

Question 5

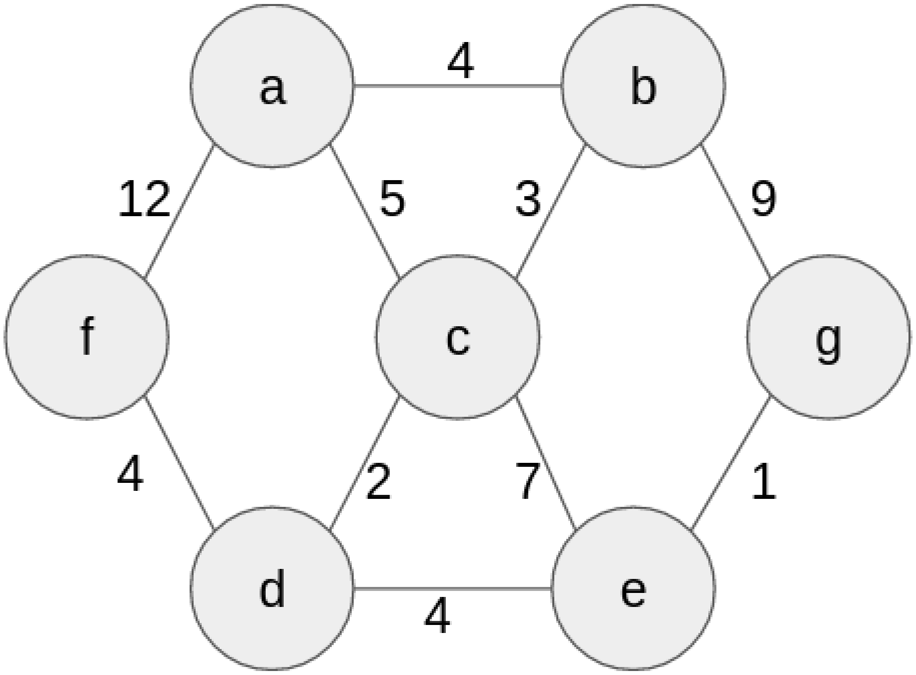
5 pts

What is the worst case runtime of the DFS algorithm on a graph with |V| nodes and |E| edges?

Question 6

10 pts

Run the Bellman-Ford algorithm on the following graph starting at node a. List the distances from node a after each pass of the algorithm.



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Question 7

15 pts

What issue(s) does the following ***iterative*** (non-recursive) DFS algorithm have? Briefly explain each problem you notice.

```
public static void dfs(ArrayList<Integer>[] g){
   Stack<Integer> stk = new Stack<Integer>();
   boolean[] vis = new boolean[n];
   while (!stk.isEmpty()) {
      int cur = stk.poll();
      vis[cur] = true;
      for (Integer x : g[cur]) {
         stk.push(x);
      }
      vis[cur] = false;
   }
}
```

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Question 8

25 pts

You have a book that you plan on finish reading over the next n days. You know how many lines are in each chapter. You require $x\log_2(x)$ time units to read a segment of x lines. You don't want to be overloaded, so you will read from at most 1 chapter per day AND you will always read an integral number of lines. You want to know the least amount of time you need to spend reading on each day such that you can complete the book.

Suppose you have 4 days to read a chapter with 1 line and 6 lines. The first chapter can be done in the first day. The remaining chapter can be read in 2 lines per day groups over the next 3 days for a total of 6 time units.

What method would you use to find the minimum required reading time? Explain at a high level your solution's method (any graph construction/greedy selection, if necessary). Explain (briefly) why your method is correct.

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Question 9

25 pts

Suppose you want to find the maximum number of classes that can be taught in a semester. There will be given n teachers, m classes, and k time slots. Each class is part of 1 particular time slot. You know which classes that each teacher is willing to teach, and you know the maximum number of classes each teacher is capable of teaching. Assume that the classes cannot have their times changed to fit a teacher's schedule. What method would you use to find the maximum number of teachable classes (given that each class can be scheduled to not have a conflict)? Explain at a high level your solution's method (any graph construction/greedy selection, if necessary). Explain (briefly) why your method is correct.

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Question 10

25 pts

Suppose you have a list of people that are present while a crime takes place. You take their statements and you wish to analyze to them to see which people or groups of people are reliable in terms group consistency. One method is analyzing just the order in which the group appears at the scene. You can collect a series of information snippets in the form of “When x arrived y was already present.” Assuming no two people arrive at the same time it should be easy to check if a set of statement is contradictory.

Write function that will return true if there is not contradiction, and false otherwise. The statements will be given as a 2D array of integers representing that input[0][i] came after input[1][i] is the i-th statement. You can call another function, or make another class, if necessary.

```
public static boolean isValid(int[][] statements) {

    // Your code here

}
```

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