

Name: _____

1. (1 pt.)

- **Read all material carefully.**
- *If in doubt whether something is allowed, ask, don't assume.*
- You may refer to your books, papers, and notes during this test.
- E-books and electronic resources may be used, *but only as a library* without direct communication with sentient beings.
- No interactive communication (other than that required for class) is permitted.
- Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
- Use class and textbook conventions for notation, algorithmic options, etc.

Write your name in the space provided above.

WAIT UNTIL INSTRUCTED TO CONTINUE TO REMAINING QUESTIONS.

Do not write in the following table.

Q	Full Score
1	1
2	9
3	10
4	15
5	5
6	5
total	45

2. (9 pts.) Refer to Figure 16.1 (p. 538) in the textbook, which depicts a trace of some operations performed on the dynamic-array implementation of the Stack data structure. Depict a similar trace (following the same conventions, depicting all the details) but starting with a *newly created* stack to which the following operations are applied, in order: *push(3)*, *push(1)*, *push(4)*, *topAndPop()*, *push(1)*, *push(5)*, *push(9)*. Ensure that your trace corresponds exactly with the actions of the textbook's code.

3. (10 pts.) Refer to Figure 15.26 (p. 512) in the textbook, which depicts a trace of Dijkstra's algorithm on the sample graph with V_0 as the source vertex. Depict the *first four iterations* (after initialization) of a similar trace on the same graph *but with V_1 (V -one) as the source vertex*. Ensure that you *clearly* indicate *all* the details following the conventions of that figure precisely.

4. (15 pts.) Using precisely the format and conventions of Figure 15.5 (p. 495) of the textbook, depict the data structure corresponding to the final graph of Figure 15.26 (p. 512).

5. (5 pts.) Refer to the implementation of `lower_bound` in Figure 7.9 (p. 244) of the textbook. Write a code fragment for instantiating this template (either of the two versions in the figure) on a vector of doubles.

6. (5 pts.) Depict a trace of the first three iterations (or fewer, if it ends sooner) of the while loop of the above (Question 5) on an input vector with elements (in order, as doubles): 2 3 5 7 11 13 17 19 23 when searching for 21. Depict the state of `low`, `high`, and `mid` at line 22 (just after assignment to `mid`) of the loop for each of the iterations.