

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 may be used *subject to the restrictions* noted in class.
- Computers are not permitted, except when used strictly as ebooks.
- Network access of any kind (cell, voice, text, data, ...) is not permitted.
- Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
- Use class and textbook conventions for notation, algorithmic options, etc.

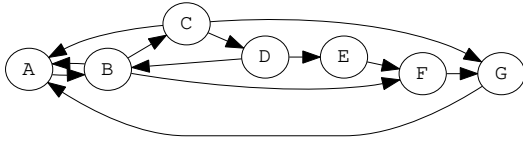
Write your name in the space provided above.

WAIT UNTIL INSTRUCTED TO CONTINUE TO REMAINING QUESTIONS.

Do not write on this page below this point.

Q	Full Score
1	1
2	3
3	6
4	25
5	25
total	60

2. (3 pts.) Provide the conventional formal representation of the graph depicted below. That is, provide the values of V and E for the conventional representation $G = (V, E)$. List vertices and edges in *lexicographic order*.



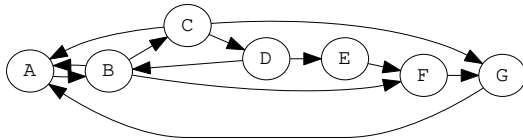
3. (6 pts.) *Using the textbook's conventions*, depict the *adjacency list* representation of the graph of Question 2. Whenever there is a choice in ordering, use alphabetical order. *Include all augmentations* needed to this data structure for its use in both of the algorithms: *BFS* and *DFS*. Explain the augmentations briefly.

4. (25 pts.) Trace the operation of BFS (the textbook's pseudocode for *breadth-first search*, on page 595), with initial vertex A, on the graph of Question 2, using the conventions of Figure 22.3 of the textbook or the conventions used in class.

Depict the state of the key data structures *after each iteration* of the while loop used in BFS.

When there is a choice, visit vertices in *alphabetical order*.

Clearly indicate all relevant details, such as node and edge colors (types) and the state of the queue. Use abbreviations such as W, G, and B for white, gray, and black, vertices, respectively. Label tree edges with a T.



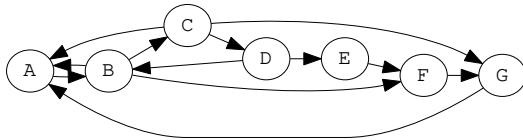
[additional space for answering the earlier question]

5. (25 pts.) Trace the operation of DFS (the textbook's pseudocode for *depth-first search*, on page 604) on the graph of Question 2, using the conventions of Figure 22.4 of the textbook or the conventions used in class.

Depict the state of the key data structures *after each invocation* of DFS-VISIT.

When there is a choice, visit vertices in *alphabetical order*.

Clearly indicate all relevant details, such as node edge colors (types) and discovery and finishing times. Use abbreviations such as W, G, and B for white, gray, and black, vertices, respectively. Label tree, forward, backward, and cross edges with T, F, B, and C, respectively.



[additional space for answering the earlier question]

[additional space for answering the earlier question]