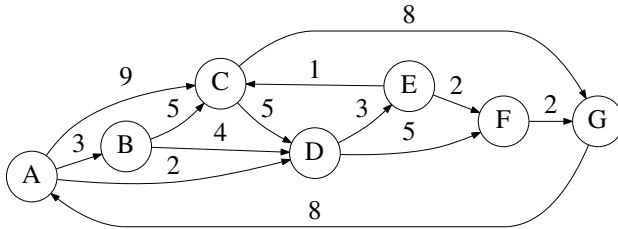**Name:** _____

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.
    - No computer or network access of any kind is allowed (or needed).
    - Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
    - Use class and textbook conventions for notation, algorithmic options, etc.
    - Budget your time: roughly one minute per point.

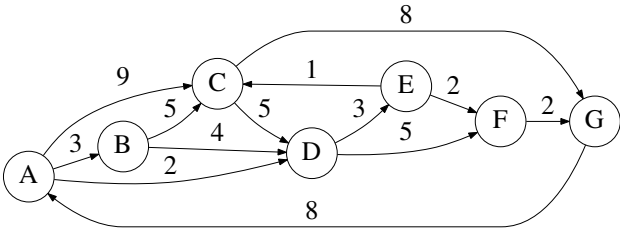   Write your name in the space provided above.

   Wait until instructed to continue to remaining questions.

1

2. (19 pts.) Trace the execution of the Dijkstra's single-source shortest paths (SSSP) algorithm on the following directed graph, with vertex A as the source.

- Use the textbook's Fig. 24.6 (p.659) as a model.
- Visit the neighbors of each vertex in lexicographic order.
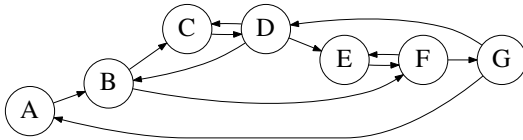- Annotate predecessor edges with check marks.

3. (20 pts.)

    (a) Reduce the following instance of 3-CNF-SAT to an instance of SUBSET-SUM by using the reduction described in the textbook.

    (b) Solve the SUBSET-SUM instance using any method, but explain why your answer is correct.

    (c) Use the above solution to solve the 3-CNF-SAT instance, explaining your answer.

$$(x \vee \neg y \vee z) \wedge (\neg x \vee y \neg \vee z) \wedge (x \vee \neg y \vee z) \wedge (\neg x \vee y \vee \neg z)$$

[additional space for answering the earlier question]

$$(x \lor \neg y \lor z) \land (\neg x \lor y\neg \lor z) \land (x \lor \neg y \lor z) \land (\neg x \lor y \lor \neg z)$$

4. (20 pts.) Trace the operation of DFS-Visit(G, A), for the following directed graph G using the conventions of Figure 22.4 (p. 605) of the textbook. In particular:

- Depict the state of the graph after each iteration of the for loop.
- Annotate each vertex with its color: **W**hite, **G**ray, **B**lack.
- Record the discovery and finishing times in the format **d/f**.
- Highlight tree edges using double lines, and annotate **F**orward, **B**ackward, and **C**ross edges.