

Name: _____

1. (1 pt.)

- **Read all material carefully.** Ask for clarifications if needed.
- You may refer to your books, papers, and notes during this test.
- No computer or network access of any kind is allowed (or needed).
- Write, and draw, carefully. Ambiguous or cryptic answers receive zero credit.
- Use the conventions used in class and the textbook for notation, algorithmic options, etc.

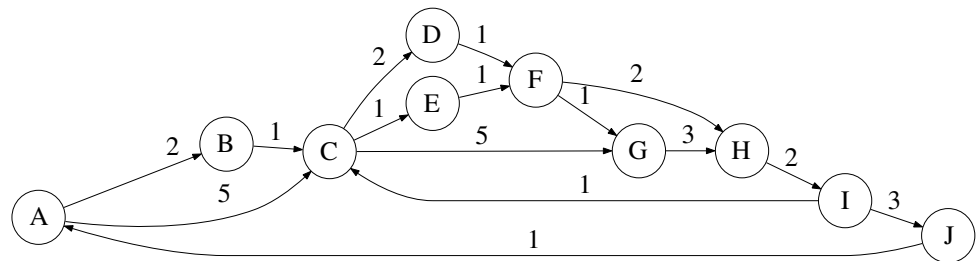
Write your name in the space provided above.

2. (20 pts.) Trace the execution of Dijkstra's shortest-path algorithm, with a pairing heap, from source vertex A on the following graph. Follow the textbook's algorithm and conventions as discussed in class.

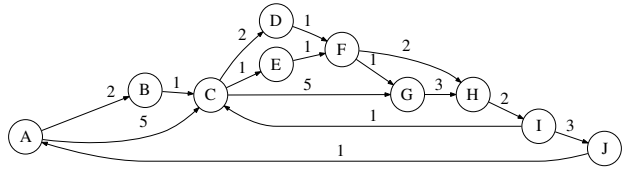
Depict (1) the D_w values and (2) the state of the heap after the computation of the shortest path to each vertex.

Highlight each deleteMin and decreaseKey operation.

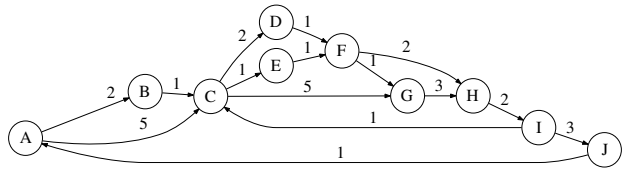
In the heap, use notation X_y for a node with label X and key y (e.g., A_0 , B_2).



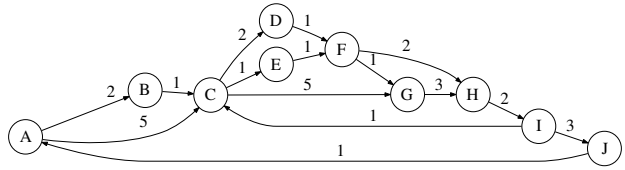
[additional space for answering the earlier question]



3. (20 pts.) Repeat Question 2 using skew heaps.

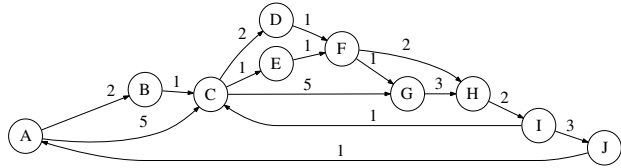


[additional space for answering the earlier question]



4. (19 pts.) For the graph of Question 2:

- (a) List all directed simple cycles.
- (b) Depict each strongly connected component.
- (c) List the number of distinct simple paths from A to J.



[additional space for answering the earlier question]

