CSCI 3104, Algorithms   **Profs. Chen & Grochow**
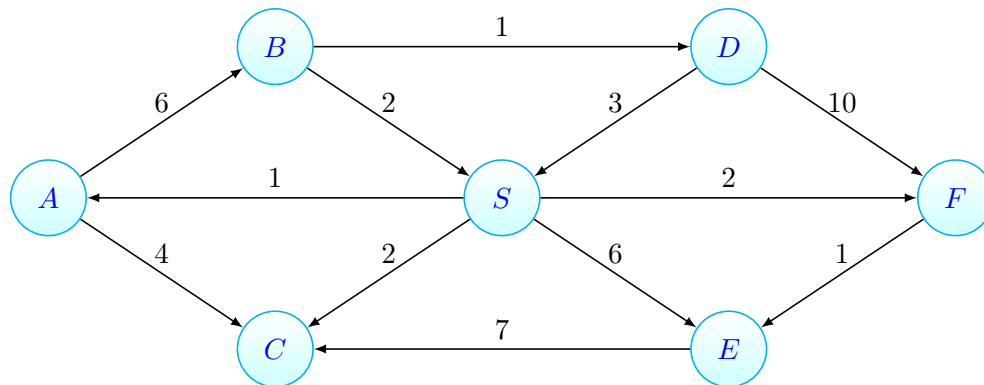**Exam 2 − S15**   **Spring 2020, CU-Boulder**

Instructions: This quiz is open book and open note. You **may** post clarification questions to Piazza, with the understanding that you may not receive an answer in time and posting does count towards your time limit (30 min for 1x, 37.5 min for 1.5x, 45 min for 2x). Questions posted to Piazza **must be posted as PRIVATE QUESTIONS.** Other use of the internet, including searching for answers or posting to sites like Chegg, is strictly prohibited. Violations of these are grounds to receive a 0 on this quiz. Proofs should be written in **complete sentences. Show and justify all work to receive full credit.**

YOU MUST SIGN THE HONOR PLEDGE. Your quiz will otherwise not be graded. Honor Pledge: On my honor, I have not used any outside resources (other than my notes and book), nor have I given any help to anyone completing this assignment.

Your Name: Daniel Kim _____

Standard 15. Consider the following directed, weighted graph G. At the first iteration of Dijksrta's Algorithm, using S as the source vertex, we examine the edges $(S, A), (S, C)$, and (S, E) edges by placing them into a priority queue. However, only (S, A) is **selected** at the first iteration.

(Questions begin on next page)

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CSCI 3104, Algorithms   **Profs. Chen & Grochow**
Exam 2 – S15   **Spring 2020, CU-Boulder**

(a) What are the next five edges **selected** by Dijkstra's algorithm? Show your work.

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For the overall of this problem, we need to pick the vertex with the smallest distance, mark the vertex as visited, calculate and update the distances that are pointing from the vertex, and repeat.

So using Dijkstra's algorithm, from the initial problem, (S, A) has already been selected, so we need to say that A is visited and update the distance d(S, A) to 1. Next, there are two edges pointing from A, so we need to update the distance d(S, B) to 7 and the distance d(S, C) to 5. Comparing the two distances, C is the next closest vertex, so we pick and mark C as visited and since there are not any edges pointing from C, we stop at C. After that, the next closest vertex is B which implies that we need to pick and mark B as visited and update d(S, D) to 8. There are two edges pointing from B but we only need to pick D because (B, S) is already visited. So we pick and mark D as visited and update the distance d(S, F) to 18. Moving on, the next closest vertex is F, so we pick and mark F as visited and update the distance d(S, E) to 19.

Therefore, these are the next five edges: $(A, C), (A, B), (B, D), (D, F), (F, E)$

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(b) After these have been selected, what are the distances from S that the algorithm has recorded for each vertex in G?

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$d(S, A) = 1$
$d(S, B) = 7$
$d(S, C) = 5$
$d(S, D) = 8$
$d(S, E) = 19$
$d(S, F) = 18$
Explanation in part a)