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CIS 315
Professor Wilson
Assignment # 7

Question 1

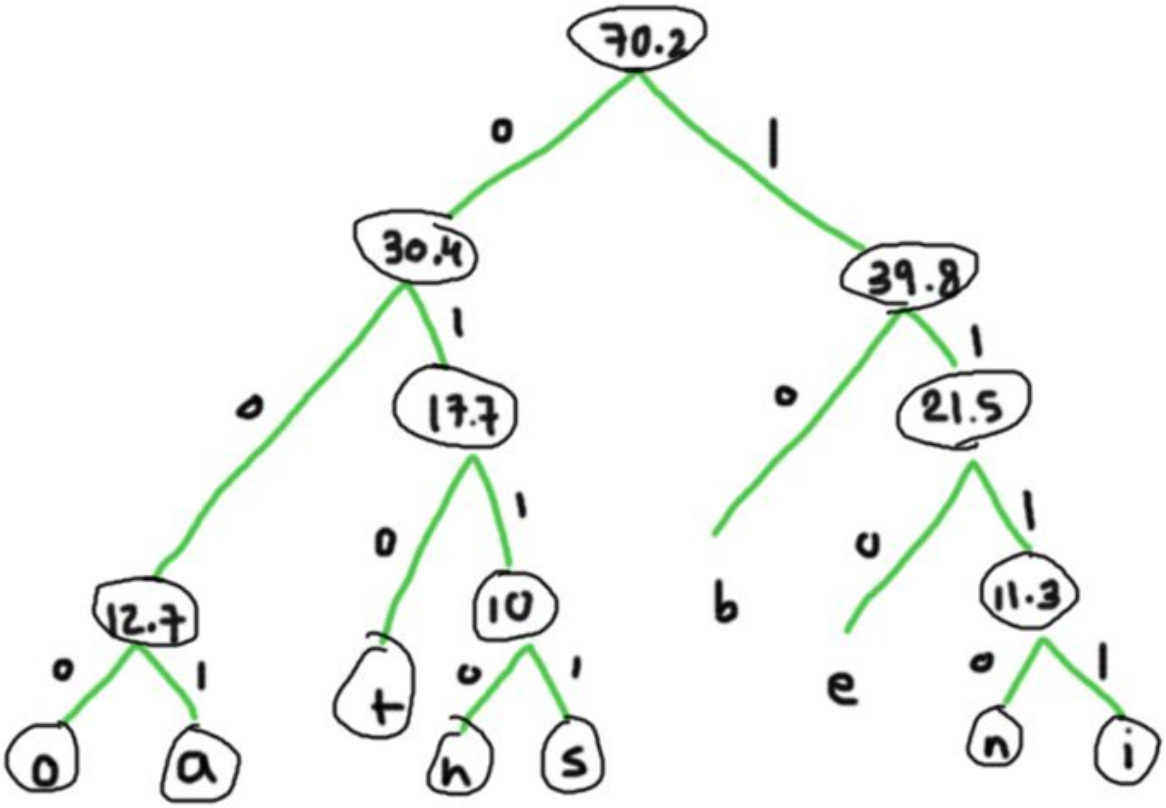
a) First, sort the group of workers from earliest start time to latest. Starting with w_1, get the set of intersecting workers (workers who overlap with w_1's shift). Then, out of this set, choose the worker with the latest end time, discarding the rest. Repeat this process with the previously chosen worker.

b) If there were a schedule S with an optimal solution not chosen by this greedy method, an exchange of the differentiating workers w_i and w_j would result in the desired choice. For example, consider schedule S:
w_1 = (2:00, 4:00)
w_2 = (3:00, 5:00)
w_3 = (3:00, 5:00)
In S, an optimal solution is to choose $\{w_1, w_3\}$. However, the greedy method would first see w_2 and pick the resulting array C as $\{w_1, w_2\}$. Exchanging these two elements w_2 and w_3, however, would result in the desired optimal solution and retain correctness.

c) First sort each worker into an array by their start time. Hold these workers in array W. Starting with the first worker, get set S of all workers whose schedule intersect with w_1. Of these workers, choose the worker w_i with the latest end time and select it as the next worker to add to set C. After this selection, remove from W w_i and all workers whose end time was less than or equal to w_i's (they no longer need to be considered).
Continue this process with w_i until W is empty.

d) This algorithm would take $O(n^2)$ time where n is the number of workers.

Question 2



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Question 3

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constraints[x][y] = false if x != y, true if x == y
satisfied(constraints[][], variables[]):
      for var in variables:
            MakeSet(var)
      for x, y in constraints:
            if constraints[x][y]:
                  Union(variables[x], variables[y])
      for x, y in constraints:
            if !constraints[x][y]:
                  if FindSet(variables[x]) == FindSet(variables[y]):
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                        return False
    return True
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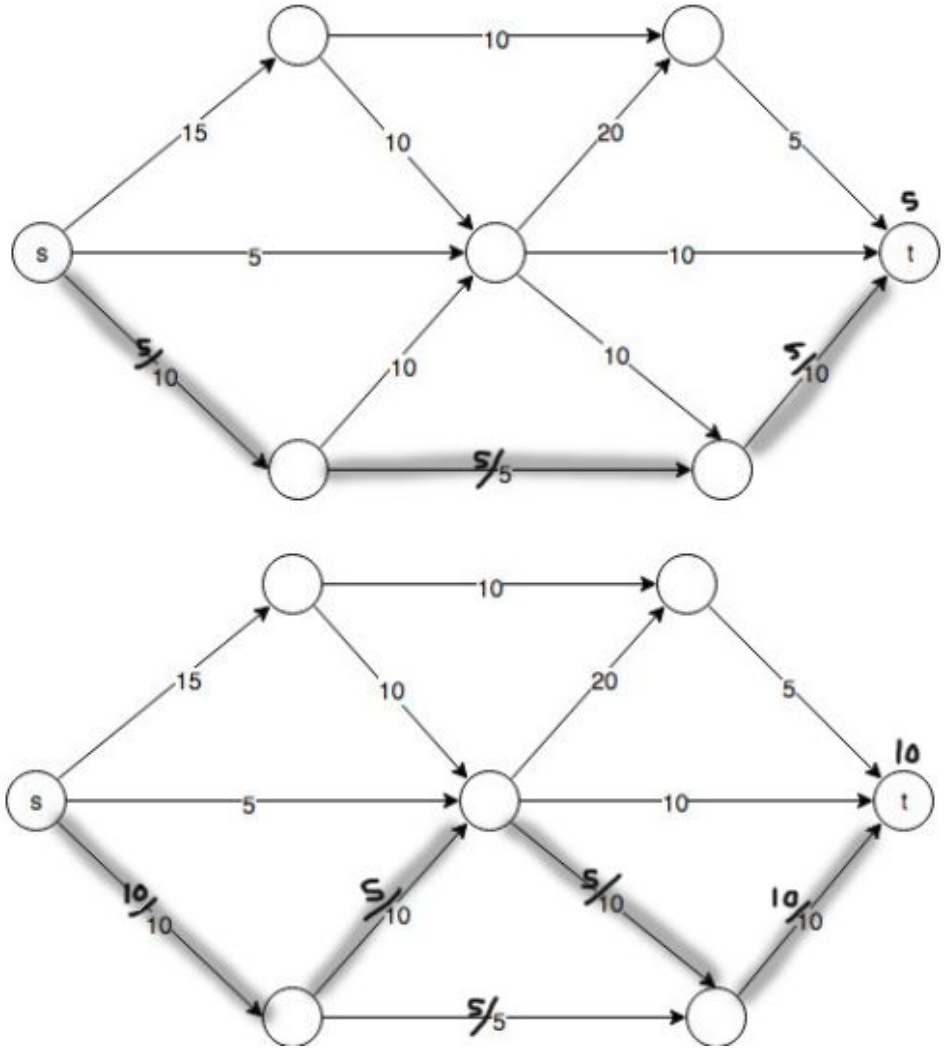
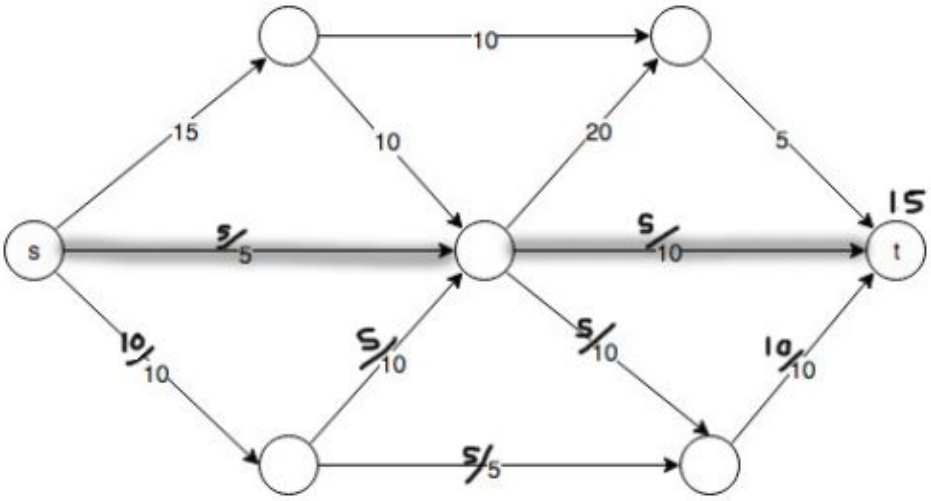
Question 4

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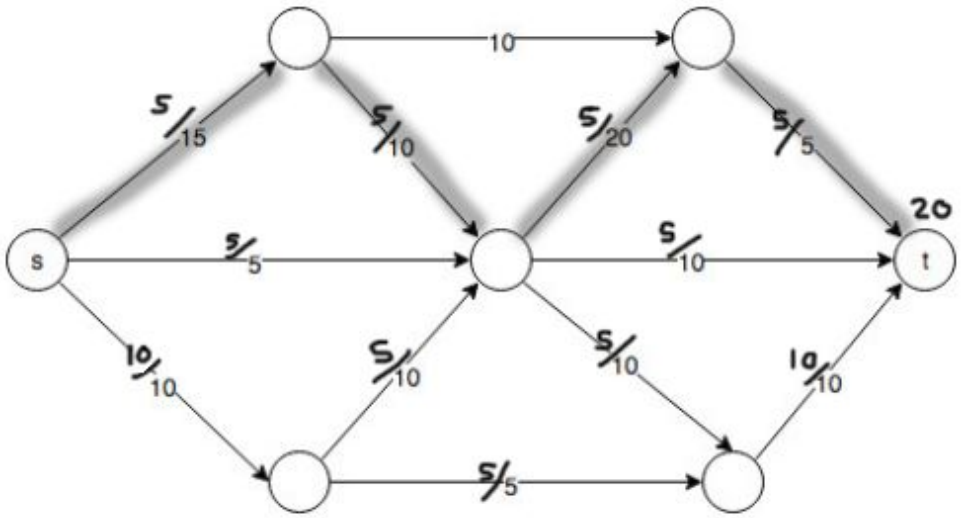
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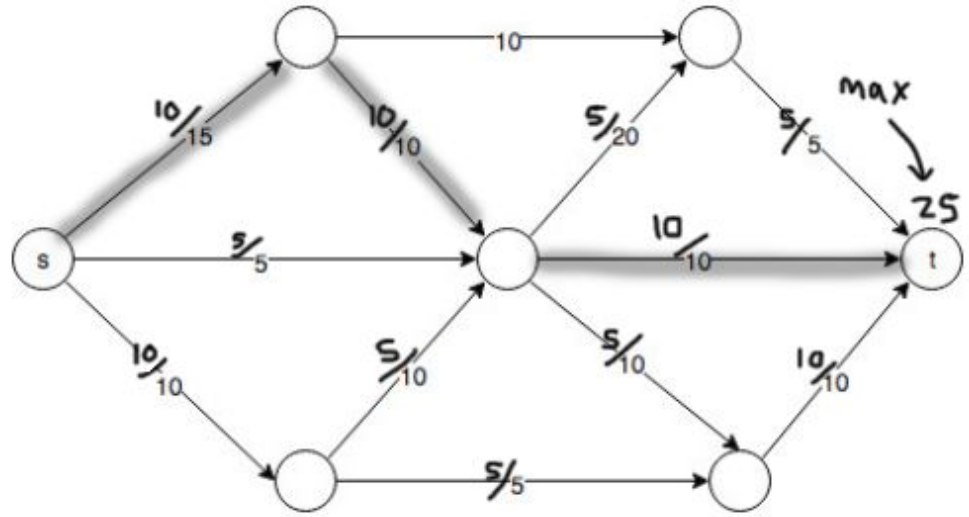
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