Name:_____________________________ **ID:**_____________________________

CSE 246 Analysis of Algorithms

Spring 2016 Final

Duration: 110 minutes

Q1	Q2	Q3	Q4	Q5	Q6	SUM
/20	/20	/13	/20	/20	/18	/100

Q-1. (20 pts) (a – 2x4=8 pts) How many character comparisons will the Horspool algorithm make in searching for each of the following patterns in the binary text of 1000 zeros? (Show shift table for each case)

(i) 01000

(ii) 010101

(b – 2x6=12 pts) Repeat (a) for Boyer-Moore algorithm. (Show bad-symbol and good-suffix tables for each case)

(i) 01000

(ii) 101010

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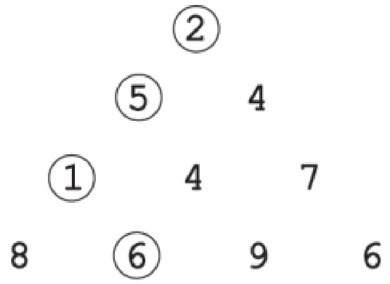
Q-2. (20 pts) ***Minimum-sum descent.*** **Some positive integers are arranged in an equilateral triangle with** ***n*** **numbers in its base like the one shown in the figure below for** ***n*** **=4. The problem is to find the smallest sum in a descent from the triangle apex (tepe noktası) to its base through a sequence of adjacent numbers (shown in the figure by the circles).**

(a) Design a <u>dynamic programming</u> algorithm for this problem.
(b) Indicate its <u>time efficiency</u>.
(c) Apply your algorithm to the triangle shown below, in order to find the given solution.



Q-3. (13 pts) Suppose we have a file that contains ten '*a*', fifteen '*e*', twelve '*i*', three '*s*', four '*t*', thirteen blanks, one 'z' and one *newline*.

(a – 2pts) Compute the size of the file assuming each character is coded using 8 bits (ASCII code).

(b – 8pts) Using the Huffman algorithm, compute the optimal coding for each character.

(c – 3pts) What is the size of the compressed file in this case?

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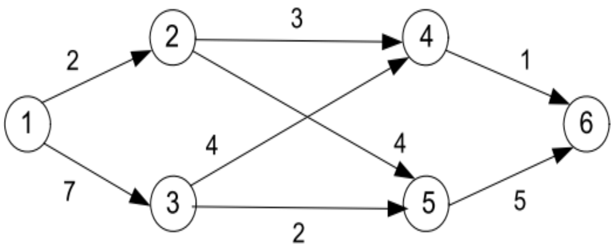
Q-4. (20pts) Apply the shortest augmenting path algorithm to find the maximum flow (source is 1 and sink is 6):

While applying BFS, visit the neighbor with smaller ID first.



(b – 3) What is the minimum cut found by the shortest augmenting path algorithm?

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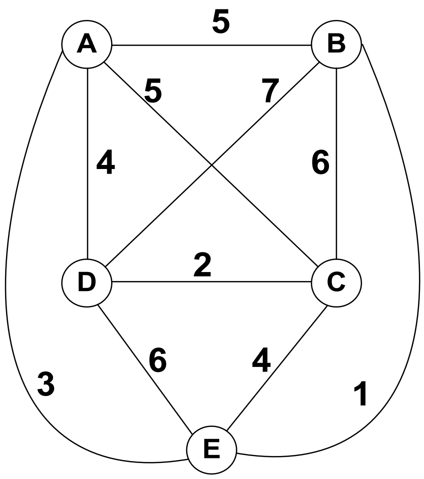
Q-5. (20 pts) Consider a <u>weighted directed graph</u> G, where weigths of edges are the utilities. Now, consider the Traveling Salesman Problem, where the goal is to find a tour with maximum utility (not minimum cost as we did in the class. Also notice that the graph is not undirected as we did in the class). Apply the <u>branch-and-bound algorithm</u> to find the tour with maximum utility in the following graph:



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Q-6. (18 pts) Lower Bound, P, NP.

(a – 3pts) Mr. Çokbilmiş claims that, for any sorted list, he found a comparison based searching algorithm SuperBinarySearch which have a worst-case time complexity of Θ(log(logn))). What is your comment?

(b – 6pts) Consider the following problem: Given adjacency matrix representation of a graph, decide whether the graph is <u>complete</u> or not. (Remember that complete graph is a graph where there is an edge between every pair of vertices.) Find a trivial lower bound class for this problem. Is this lower bound tight? Why?

(c – 5 pts) A certain problem can be solved by an algorithm whose running time is in $O(n2^n)$. Which of the following assertions is true? Explain your answer.

a. The problem is tractable.
b. The problem is intractable.
c. Impossible to tell.

(d – 4 pts) Decision versions of Traveling Salesman Problem and Graph Coloring problems are known to be NP-complete problems. Prof. X claims that he found a polynomial time algorithm for Traveling Salesman problem. If Prof. X tells true, how would you provide a polynomial time algorithm for Graph Coloring problem?