DAA Example Paper by M.Bilal

Q1) 1.1) Consider the following procedure

Procedure: Goldbach_Conjecture()

// The purpose of this procedure is to check whether every even number > 2 is the sum of two prime numbers or not.

```
n ← 4
if (n ≠ (p1 + p2)) then // p1 and p2 are prime numbers
    print "NO"
    break
else
    n ← n + 2
    goto 2
print "YES"
end.
```

1.2) Consider the following non recursive function mystery()

```
int mystery (int n)
{
    for (int c = 1; c != 0; )
    {
        if (n > 100)
        {
            n = n - 10;
            c--;
        }
```

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```
        else
        {
            n = n + 11;
            c++;
        }
    }
    return n;
}
```

What value is returned for input value n = 99.

1.3) Write recursive version of given non-recursive function mystery().

Q2)

2.1) You are given n datapoints in an array. A peak element in a given data point is defined as "The element which is greater than its adjacent elements." Design an algorithm using Decrease (by constant factor) and conquer that find all peak elements in given data points

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2.2) Design an algorithm fix the following problems using dynamic programming.
Problem: Given a pattern p and text t, find a subword w = [i....j] of t such that the edit distance between p and w is minimal.

2.3) Design an algorithm fix the following problem using greedy approach:
Problem: Given an array of non-negitive integers of length N and an integer K. Partition the given array into two subsets of length K and N-k so that the difference between the sum of both subsets is maximum.

Q3)

3.1) Establish the correctness of the following algorithm Show all steps i.e. Initialization, maintenance and termination.

```
ALGORITHM Palindromes(w, i, j, flag)
  if (i = j) then
      flag = True
  elseif (w[i] = w[j]) then
      flag = True
      Palindromes(w, i+1, j-1, flag)
```

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```
else
        flag = false
```

Q 4)4.1) Find the time complexity of the following code. Use most suitable notation among O, Ω and Θ to specify efficiency of the code

```
void fun(int n)
{
    int i=0, j= 1;
    while ( i < n)
    {
        // some O(1) task
        i = i + j;
        j++;
    }
}
```

4.2) Two friends Ali and Umar are working in a software house. Their project manager gives them a problem P, and confines them only employ "divide and conquer" design paradigm for solving given problem P.
Both come up with following solutions:

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Ali's solution: He divides the given problem of size n into three sub-problems of each size n/2, n/4, and n/8 respectively; and his model for combining solution of subproblems take a time in $\Theta(n)$.

Umar's solution: He divides the given problem of size n into 2 sub-problems each of size n/5, and 7n/10, and his module for combining solution of sub-problems take a time in $\Theta(n)$.

Whose algorithm is ~~better~~ efficient? Justify your answer.

Q5)

5.1) Let Algorithm A_1 and algorithm A_2 have worst-case time bound p and q respectively. Suppose algorithm A_3 consist of applying A_2 to the output of A_1. Give a worst-case time bound for A_3. (The input for A_3 is input for A_1). Explain your Answer.

5.2) Write NP Algorithm for searching problem that find given key in constant time.

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