National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 1
2nd Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1 Point

Question 1:

Is the provided statement true or false? Prove your answer.
$n^2 + 2^n = \Theta(n^2)$ [Even Column]
$n^2 + 2^n = \Theta(2^n)$ [Odd Column]

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 1
2nd Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1 Point

Question 1:

Is the provided statement true or false for larger values of n?
Prove your answer.
$n^2 + 2^n \leq n^2$ [Even Column] False
$n^2 + 2^n \leq 2^n$ [Odd Column] True (debatable on the results)

Hint: $\lim_{n\to\infty}(n/(\log n)) = \infty$

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National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 1
2nd Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
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Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1 Point

Question 1:

Does there exists a value n for which the provided inequality is true.
$n^2 + 2^n \leq n^2$ [Even Column] No
$n^2 + 2^n \geq 2^n$ [Odd Column] YES $[1, \infty)$

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National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 1
2nd Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1 Point

Question 1:

Provided an algorithm with time complexity of $\log n$ [Even Column] and 2^n[Odd Column], how much input can be executed in one second on a processor having execution speed of 10^6instructions /second.

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 2
16th Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Solve the following recurrences to compute the non-recursive time complexity.

$\boldsymbol{T(n) = 4T(n-1) + 1}$
$T(n) = 4T(n-1) + 1 \rightarrow eq1$

$T(n-1) = 4T(n-2) + 1 \rightarrow eq2$

$T(n-2) = 4T(n-3) + 1 \rightarrow eq3$

$T(n-3) = 4T(n-4) + 1 \rightarrow eq4$

By eq. 1, 2, 3 and 4

$T(n) = 4^2T(n-2) + 1 + 4$

$T(n) = 4^3T(n-3) + 1 + 4 + 4^2$

$T(n) = 4^3T(n-3) + \sum_{j=0}^{3} 4^j$

…

$T(n) = 4^iT(n-i) + \sum_{j=0}^{i} 4^j$

$for\ i = n$

$T(n) = 4^nT(n-n) + \sum_{j=0}^{n} 4^j$

$T(n) = \theta(4^n)$

$\boldsymbol{T(n) = T\left(\frac{n}{2}\right) + \log n}$
$a = 1, b = 2, f(n) = n^0 logn$
$n^{\log_b a} = n^0$
$n^{\log_b a} \log n = f(n)$
$T(n) = \theta((\log_2 n)^2)$

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 2
16th Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Solve the following recurrences to compute the non-recursive time complexity.

$T(n) = 2T(n-2) + 1$

$T(n-2) = 2T(n-2*2) + 1$

$T(n-2*2) = 2T(n-2*3) + 1$

$T(n-2*3) = 2T(n-2*4) + 1$

by using above equations

$T(n) = 2^2T(n-2*2) + 1 + 2$

$T(n) = 2^3T(n-2*3) + 1 + 2 + 2^2$

$T(n) = 2^4T(n-2*4) + 1 + 2 + 2^2 + 2^3$

$T(n) = 2^4T(n-2*4) + \sum_{j=0}^{4-1} 2^j$

...

$T(n) = 2^iT(n-2*i) + \sum_{j=0}^{i-1} 2^j$

$for\ i = n/2$

$T(n) = 2^{\frac{n}{2}}T(n-n) + \sum_{j=0}^{\frac{n}{2}-1} 2^j$

$T(n) = \theta(2^n)$

$\boldsymbol{T(n) = T\left(2\frac{n}{4}\right) + n}$

$a = 1, b = 2, f(n) = n^1$

$n^{\log_b a} = n^0$

$T(n) = \theta(n)$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 2
16th Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Solve the following recurrences to compute the non-recursive time complexity.

$\boldsymbol{T(n) = T(n-1) + 2^n}$

$T(n-1) = T(n-2) + 2^{n-1}$

$T(n-2) = T(n-3) + 2^{n-2}$

$T(n-3) = T(n-4) + 2^{n-3}$

$by\ using\ above\ equations$

$T(n) = T(n-2) + 2^n + 2^{n-1}$

$T(n) = T(n-3) + 2^n + 2^{n-1} + 2^{n-2}$

$T(n) = T(n-4) + 2^n + 2^{n-1} + 2^{n-2} + 2^{n-3}$

$T(n) = T(n-4) + \sum_{j=0}^{4-1} 2^{n-j}$

...

$T(n) = T(n-i) + \sum_{j=0}^{i-1} 2^{n-j}$

$for\ i = n$

$T(n) = T(n-n) + \sum_{j=0}^{n-1} 2^{n-j}$

$T(n) = \theta(2^n)$

$\boldsymbol{T(n) = 2T\left(\frac{n}{2}\right) + n \log n}$

$a = 2, b = 2, f(n) = n \log n$

$T(n) = n(\log n)^2$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 2
16th Sep 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Solve the following recurrences to compute the non-recursive time complexity.

$T(n) = 2T(n-1) + 1$

$T(n) = T\left(\frac{n}{2}\right) + 2^n$

Solution:

$T(n) = \theta(2^n)$

$T(n) = \theta(2^n)$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 3
7th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Write an iterative algorithm for the provided recurrence of C_r^n.

$$C_r^n = \begin{cases} C_r^{n-1} + C_{r-1}^{n-1} & if \quad 0 < k < n \\ 1 & if \quad k = 0 \; or \; k = n \end{cases}$$

```
C(n, r)
    for i ∈ r
        for j ∈ i → n
            if(i == j ot i == 0)
                A[i, j] = 1
            else
                A[i, j] = A[i − 1, j − 1] + A[i, j − 1]
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 3
7th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Write an iterative algorithm to initialise a two dimensional array A[1..n, 1..n] using following definition.

$$A[i,j] = \begin{cases} i+j & if \quad i=j \\ Min(A[i,\ j-1],\ A[i+1,\ j]) + (i+j) & if \quad i<j \\ Max(A[i-1,\ j],\ A[i,\ j+1]) + (i * j) & if \quad i>j \end{cases}$$

Where i is for row index and j is for column index.

```
Algo(x, y)
    for i ∈ x
        for j ∈ y
            if (i == j)
                A[i, j] = i + j
            if (i < j)
                A[i, j] = min(A[i, j − 1], A[i + 1, j]) + (i + j)
            if (i > j)
                Max(A[i − 1, j], A[i, j + 1]) + (i * j)
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 3
7th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** F

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Write an iterative algorithm to initialise a 2-dimensional array A[1..n, 1..n] using following definition.

$$A[i,j] = \begin{cases} 1 & if \quad i = 0 \; or \; j = 0 \\ Min(A[i,\, j-1],\, A[i+1,\, j]) + \; (i+j) & if \quad i \neq 0 \; and \; i \leq j \\ Max(A[i-1,\, j],\, A[i,\, j+1]) + \; (i * j) & if \quad j \neq 0 \; and \; i > j \end{cases}$$

Where i is for row index and j is for column index.

```
Algo(x, y)
    for i ∈ x
        for j ∈ y
            if (i == 0 or j == 0)
                A[i, j] = 1
            if (i ≠ 0 and i ≤ j)
                A[i, j] = min(A[i, j − 1], A[i + 1, j]) + (i + j)
            if (j ≠ 0 and i > j)
                Max(A[i − 1, j], A[i, j + 1]) + (i * j)
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 3
7th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No: G**

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Write an algorithm to fill a 2-D array of size (n*k) using the recursion provided below.

$$A[n,k] = \begin{matrix} A[n-1,k-1] & if & 0 < k < n \\ 1 & if & k = 0 \; or \; k = n \end{matrix}$$

```
Algo(n, r)
    for i ∈ r
        for j ∈ i → n
            if(i == j ot i == 0)
                A[i, j] = 1
            else
                A[i, j] = A[i − 1, j − 1]
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 4
14th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Design a divide and conquer algorithm for computation of optimal value in 0-1 Knapsack problem.
Given: A set S of n items, with each item i having

- b_i - a positive "benefit"
- w_i - a positive "weight"

Goal: Choose items with maximum total benefit but with weight at most W.

Solution:

$Algo(n, W)$
    $if(W == 0\ or\ n == 0)$
        $return\ 0$
    $return\ \max(v_n + Algo(n-1, W-w_n), Algo(n-1, W))$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 4
14th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Design a divide and conquer algorithm for computation of optimal value in 0-1 Knapsack problem.
Given: A set S of n items, with each item i having

- b_i - a positive "benefit"
- w_i - a positive "weight"

Goal: Choose items with maximum total benefit but with weight at most W.

Solution:

$Algo(n, W)$
    $if(W == 0 \; or \; n == 0)$
        $return \; 0$
    $return \; \max(v_n + Algo(n-1, W-w_n), Algo(n-1, W))$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 4
14th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** F

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Given a sequence of numbers such that the difference between the consecutive terms is constant, design an divide and conquer algorithm to find missing term in it in $O(\log n)$ time.
Example: 1, 4, 7, 10, 16, 19
The missing term: 13

Solution

1) $d = \frac{A[end]-A[st]}{n}$
2) $Missing(st, end)$
   a) $if(st == end)\ return\ -1$
   b) $if(mid + 1 < n\ and\ A[mid + 1] - A[mid] \neq d)$
      i) $return\ A[mid + 1] - d$
   c) $if(mid - 1 \geq 0\ and\ A[mid] - A[mid - 1] \neq d)$
      i) $return\ A[mid - 1] + d$
   d) $if(mid - 1 \geq 0\ and\ A[mid] - A[0] \neq (mid - 0) * d)$
      i) $return\ Missing(st, mid - 1)$
   e) $else\ return\ Missing(mid + 1, end)$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 4
14th Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** G

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 15 minutes **Max Marks:** 1.5 Point

Question 1:

Given a sequence of descending order sorted numbers such that the difference between the consecutive terms is constant, design an divide and conquer algorithm to find missing term in it in $O(\log n)$ time.
Example: 15, 12, 9, 3, 0, -3
The missing term: 6

Solution

3) $d = \frac{A[st]-A[end]}{n}$
4) $Missing(st, end)$
   a) $if(st == end)\ return\ -1$
   b) $if(mid + 1 < n\ and\ A[mid] - A[mid + 1] \neq d)$
      i) $return\ A[mid + 1] + d$
   c) $if(mid - 1 \geq 0\ and\ A[mid - 1] - A[mid] \neq d)$
      i) $return\ A[mid - 1] - d$
   d) $if(mid - 1 \geq 0\ and\ A[0] - A[mid] \neq (mid - 0) * d)$
      i) $return\ Missing(st, mid - 1)$
   e) $else\ return\ Missing(mid + 1, end)$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 5
21st Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

You are given a one dimensional array that may contain both positive and negative integers, design a time optimal algorithm to find the sum of contiguous subarray of numbers which has the largest sum.
For example, if the given array is {-2, -5, 6, -2, -3, 1, 5, -6}, then the maximum subarray sum is 7.

Solution:

$MSS(n)$

$for\ i\ in\ 0 \rightarrow n$

- $sum += i$
- $if (sum < 0)$: $sum = 0$
- $if (max < sum)$: $max = sum$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 5
21st Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

You are provided with the set of n coins in an array and required to pick the coin such that the coins from two connected locations should not be collected. Design an iterative algorithm to compute the maximum number of coins.

Solution:

```
Coin(n)
    for i ∈ n
        if(i == 0)
            A[0]
        else if(i == 1)
            A[0]+= C[1]
        else
            max(c[i] + A[i − 2], A[i − 1])
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 5
21st Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** F

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Given two strings A and B, design a time optimal algorithm to find the shortest string that has both A and B as subsequences.

Solution

```
Shortest(A, B, x, y)
    int L[m + 1][n + 1]
    int i, j
    for (i = 0; i <= m; i++)
        for (j = 0; j <= n; j++)
            if (i == 0 || j == 0)
                L[i][j] = 0
            else if (X[i - 1] == Y[j - 1])
                L[i][j] = L[i - 1][j - 1] + 1
            else
                L[i][j] = max(L[i - 1][j], L[i][j - 1])
```

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 5
21st Oct 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** G

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

You are provided with the set of n coins in an array and required to pick the coin such that the coins from two adjacent/connected locations should not be collected. Design an algorithm to compute the maximum number of coins.

Solution

$Coin(n)$
    $if(n == 0)$
        $return\ 0$
    $if(n == 1)$
        $return\ C[1]$
    $return\ \max(c[n] + Coin(n-2), Algo(n-1))$

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 6
18th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1.5 Point

Question 1:

Provide the most time optimal algorithm (name or algorithm) for the searching a set of digits from a large number. E.g. searching 1245 from 4512784512452356.

Solution:

Robin Karp Algorithm

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 6
18th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1.5 Point

Question 1:

What does "P=NP?" means. Is P=NP or not?

Solution:

"P=NP?" means $\forall p \in NP \rightarrow p \in P$. The statement is not yet proved true nor false.

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 6
18th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** F

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1.5 Point

Question 1:

Provide the most time optimal algorithm (name or algorithm) for the searching a set of characters from a large paragraph. E.g. searching 12:45 from a bbc news article.

Solution

The naïve algorithm is most suitable for this type of general searching problems.

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 6
18th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** G

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 10 minutes **Max Marks:** 1.5 Point

Question 1:

Does there exist an algorithm which is NP and Polynomial as well. If YES provide the name of that algorithm.

Solution

Every Polynomial algorithm is NP. E.g. sorting, searching etc.

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 7
25th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** B

Instructions:

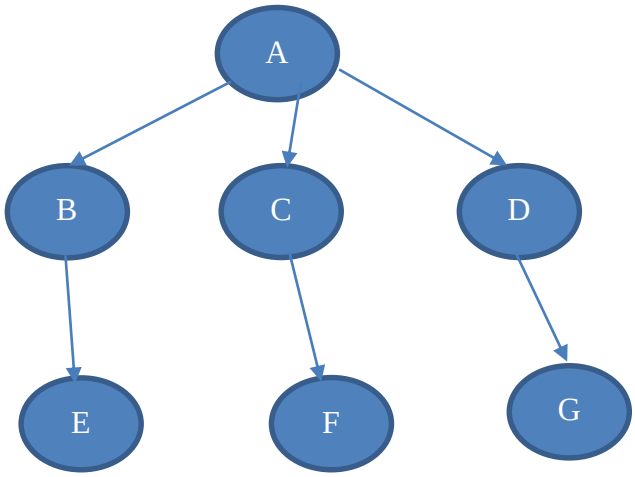
- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

A student in the class proposed the following heuristic to solve the vertex-cover problem. Repeatedly select a vertex of highest degree, and remove all of its incident edges. Is the heuristic returns optimal results (Yes/No)? Prove your answer.

Solution: NO



The approximate resulted in **ABCD** or **AEFG** but the optimal is **BCD**

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 7
25th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** D

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Consider each of the following words as a set of letters: {arid, dash, drain, heard, lost, nose, shun, slate, snare, thread}. Show which set cover GREEDY-SET-COVER produces when ties (same set of new letters) are broken in favor of the word that appears first in the dictionary.

Solution:

Items	arid	dash	drain	heard	lost	nose	shun	slate	snare	thread
New1	4	4	5	5	4	4	4	5	5	6
New2	1	1	2	0	3	3	3	2	2	0
New3	1	0	2	0	0	1	2	0	1	0
New4	0	0	0	0	0	0	1	0	0	0
New5	0	0	0	0	0	0	0	0	0	0

Selected Words {thread, lost, drain, shun}
Selected Letters {THREADLOSINU}

BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 7
25th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** F

Instructions:

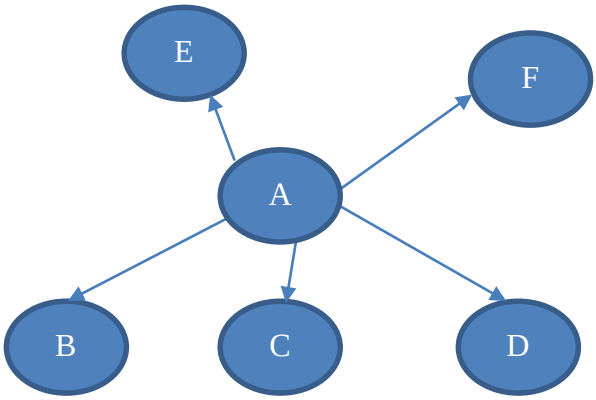
- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

Apply the following heuristic to solve the vertex-cover problem. Repeatedly select a vertex of lowest degree, and remove all of its incident edges. Give an example to show that the provided heuristic does not have a ratio bound of 2 (2-approximate).

Solution



BEST OF LUCK!

National University of Computer & Emerging Sciences, Karachi
Spring-2019 CS-Department
Quiz # 7
25th November 2019

Course Code: CS302	**Course Name:** Design & Analysis Of Algorithms
Instructor Name: Zeshan Khan	
Student Roll No:	**Section No:** G

Instructions:

- Solve on the question paper and return.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.

Time: 20 minutes **Max Marks:** 2 Point

Question 1:

A) Is there exists any polynomial time algorithm to compute MST of a graph with an additional constraint of minimal number of edges in the MST.

B) Will the polynomial time algorithm (Dynamic Programming) to compute 0/1 knapsack of a provided set of items returns optimal results, with an additional constraint of minimum weight.

Solution

A) Yes, The same algorithm
B) No, Two variable optimization

BEST OF LUCK!