# University of Asia Pacific
## Department of Basic Sciences & Humanities
## Semester Final Examination, Spring-2016
## Program: B.Sc. Engineering (Computer Science)
## 2nd Year / 2nd Semester

Course Title: Math-IV | Course Code: MTH-203

Time: 3.00 Hrs. | Full Mark: 150

There are **Eight** questions. Answer any **Six (6)** of the followings:

1. a) Find $\nabla\varphi$ if i) $\varphi = \log|\vec{r}|$ ii) $\varphi = \frac{1}{|\vec{r}|}$. 13

b) If $\varphi = 2x^3y^2z^2$. Find div(grad $\varphi$). 12

2. a) If $\vec{A} = x^2y\hat{i} - 2xz\hat{j} + 2yz\hat{k}$. Find curl curl $\vec{A}$. 13

b) Prove that $\nabla\left(\frac{\vec{r}}{|\vec{r}^3|}\right) = 0$. 12

3. a) If $\mathcal{L}\{F(t)\} = f(s)$. Then prove that $\mathcal{L}\{F'(t)\} = sf(s) - F(0)$ and hence also prove that $\mathcal{L}\{\sin at\} = \frac{a}{s^2+a^2}$. 13

b) Evaluate $\mathcal{L}^{-1}\{\frac{3s+7}{s^2-2s-3}\}$. 12

4. a) Solve the differential equation $Y'' + Y = t$, where $Y(0) = 1$ and $Y'(0) = -2$. 13

b) Solve $\begin{cases} \frac{dX}{dt} = 2X - 3Y \\ \frac{dY}{dt} = Y - 2X \end{cases}$ subject to $X(0) = 8$ and $Y(0) = 3$ 12

5. a) Evaluate $\int_0^{2\pi} \frac{d\theta}{3+3\sin\theta}$ by the method of contour integration. 15

b) Define bilinear transformation. Prove that the product of two bilinear transformations is again a bilinear transformation. 10

6. Define Fourier series. Consider $f(x) = x + x^2$, $-\pi < x < \pi$. Find Fourier expansion of $f(x)$. Hence prove that $\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots$ 25

7. a) If $f(x) = \begin{cases} \pi x, & 0 < x < 1 \\ \pi(2 - x), & 1 < x < 2 \end{cases}$. Then find half range Fourier cosine series of $f(x)$. 18

b) Find the Fourier integral of the function $f(x) = e^{-kx}$, $x > 0$ and $f(-x) = f(x)$ and $k > 0$. 7

8. a) Find the Fourier sine transform of $F(x) = e^{-x}, x \geq 0$ 7

b) Use finite Fourier transforms to solve . 18

$\frac{\partial U}{\partial t} = 3\frac{\partial^2 U}{\partial x^2}$, $U(0,t) = U(2,t) = 0$, $U(x,0) = x$, where $0 < x < 2$, $t > 0$

$\int_0^\infty e^{-t} F(t)\, dt$

$e^{-t} \int_0^\infty F(t) - \int_0$

# Department of Computer Science & Engineering
## University of Asia Pacific (UAP)

**Final Examination** **Spring 2016** **2nd Year 2nd Semester**

**Course Code: CSE 211** **Course Title: Assembly Language Programming** **Credits: 2**

**Full Marks: 100** **Duration: 2 Hours**

There are **Six** Questions, answer any **Four**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) What is procedure? Write down the two other instructions used in procedure (in details)? 10

(b) Write a program to check whether a number is PERFECT NUMBER or not? 15

| Sample Input | Sample Output |
|---|---|
| 9 | NOT PERFECT NUMBER |
| 6 | PERFECT NUMBER |

2. (a) What is Stack? What happened when **PUSH** and **POP** instruction execute (with example)? 10

(b) Suppose, AX = $4AB1_h$, BX=$9B8E_h$, CX= $67DC_h$, Flag register=$1110110111110111_b$ and SP = 00F4h. After executing the following instructions what will be the value of AX, BX, CX, Flag register and SP (in hex)? 10

*ADD BX, CX*
*PUSHF*
*PUSH AX*
*XCHG AX, BX*
*POP BX*
*POP CX*
*MOV CX, AX*
*PUSH CX*
*POPF*

(c) What is the limitation of conditional jump instruction and how can we avoid that (with example)? 5

**3. (a)** Perform the following logic operation:

**(i)** *NOT* ('e') *OR* $A9_h$
**(ii)** $11011001_b$ *XOR* *NOT*('3')

**(b)** Write down a code in assembly to take a string input from user and print in reverse order (use stack).

**4. (a)** Define **ROL** & **RCL** with appropriate figures.

**(b)** Write down the difference between **TEST and AND** instructions.

**(c)** Convert the following program into Assembly Language:

```
int main(){
        int num;
        // input must be between 0 to 9
        scanf("%d", &num);
        if( ( num % 2 ) == 0 ){
                printf("Even");
        }
        else{
                printf("Odd");
        }
        return 0;
        }
```

**5. (a)** Use appropriate *Logical Instruction*:

**(i)** How to convert Number to ASCII Digit
**(ii)** How to convert Lower Case to Upper Case.

**(b)** Is Divide overflow possible? Suppose DX= 0000h, AX = FFF3h, BX = FFFAh; after executing DIV and IDIV instruction what will be the value of quotient, remainder, AX and DX.

**(c)** What are one's and two's complement? What will be the two's complement of $FE_h$?

**6. (a)** For the memory location whose physical address is specified by FF0E0h, give the logical address for segment address 123Fh.

**(b) (i)** Put 40256 in DX and then use **Shift instruction** to multiply value of DX by 256.
**(ii)** Use **Shift instruction** to divide the unsigned number 98521 by 128. Put the quotient in CX.

**(c)** Suppose AL=$CE_h$ , CF=1 and CL=4. Give the new contents of AL and CF after each of the following instructions is executed.

```
RCR    AL, CL
NOT AL
ROL AL, CL
DEC CL
SHR AL, CL
```

Best of Luck!!!

# Department of Computer Science & Engineering
## University of Asia Pacific (UAP)

**Final Examination** | **Spring 2016** | **2nd Year 2nd Semester**
**Course Code: CSE 209** | **Course Title: Numerical Methods** | **Credits: 3**
**Full Marks: 150** | | **Duration: 3 Hours**

**Instructions:**

1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. (a) Using Euler's method, if $y' = x^2 + y^2$ and $y(1) = 2$, find $y(0.5)$ where $n = 5$. 14

   (b) Form a forward difference table based on the values of $\log_{10} x$ for $x = 5.5(0.15)6.55$. 11

2. (a) Convert $(10010001010010010)_2$ into the Decimal form using the iterative algorithm. 13

   (b) Find an approximate solution, by Picard's method, to the initial value problem $y' = 2 + y^3$, where $y(0) = 2$. 12

3. (a) What is Numerical Integration? Why is it useful in practical problems? Provide example with figure. 4+4+5

   (b) Using Taylor's series, find the solution of the differential equation: $y' = y^4$, $y(0) = 3$ at $x = 0.01$. 12

4. (a) Define and derive Regula Falsi method. Find a real root of the equation $2x^6 - 5x^4 + 16x - 49 = 0$ by using Regula Falsi method, where the root is situated between 1.5 and 2. 5+12

   (b) What is the cause behind the name of Aitken's $\Delta^2$-process of acceleration? Why is it faster? 4+4

5. (a) Show that, $\varepsilon_{n+1} \approx \varepsilon_n g'(a)$ , where each variable has its usual meaning. 8

   (b) Define and derive Newton-Raphson method. Find a real root of the equation $2x^6 - 5x^4 + 16x - 49 = 0$ by using Newton-Raphson method, with trial value 2.1 . 5+12

6. (a) Obtain the lowest-degree polynomial which takes the following values: 13

| x | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| f(x) | -6 | -5 | 8 | 45 | 118 |

   (b) Define forward difference operator $\Delta$. Express $\Delta^7 f_0$ in terms of the ordinates. 3+9

7. (a) Evaluate $\int_6^{15} \frac{1}{x} dx$ by using Simpson's three-eighth rule $\int_{x0}^{x0+nh} f(x)dx = \frac{3h}{8}[(f_0+f_n)+ 3(f_1+f_2+f_4+f_5+\cdots+f_{n-1})+2(f_3+f_6+\cdots+f_{n-3})]$ 10

   (b) Convert $(76489)_{10}$ into the Binary form using the iterative algorithm. 15

8. (a) What is the difference between Trapezium rule and Trapezoidal rule? Which rule does give us better accuracy? Why? 4+2+2

   (b) Define: Direct Substitution Method, Iteration and Iterates. Show examples. 7+5+5

# Department of Computer Science & Engineering
## University of Asia Pacific (UAP)

**Final Examination** **Spring 2016** **2nd Year 2nd Semester**

**Course Code: IMG 201** **Course Title: Principles of Management** **Credits: 2**

**Full Marks: 50** **Duration: 2 Hours**

**Instructions:**

1. *Answer any Five questions from Question # 1 to 7*
2. *Answer any Two questions from Question # 8 to 10*

*Briefly explain with example:* *Marks: 5 @ 6*

Q#1: Explain the Informal Organization.

Q#2: Describe the Narrow Span of management.

Q#3: Describe the various Leadership Styles.

Q#4: Explain the Physiological Needs and Esteem Needs.

Q#5: Describe the 'Theory Y' assumptions.

Q#6 What is the Basic Control process?

Q#7: What do you mean by E-commerce?

*Explain in detail with example:* *Marks: 2 @ 10*

Q#8: Explain the Delphi technique process.

Q#9: Explain the Bases of Power.

Q#10: Describe the Equity theory of motivation.

# Department of Computer Science & Engineering
## University of Asia Pacific (UAP)

**Final Examination** **Spring 2016** **2nd Year 2nd Semester**

**Course Code: CSE 207** **Course Title: Algorithms** **Credits: 3**

**Full Marks: 150** **Duration: 3 Hours**

**Instructions:**

1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Define *big-O*, *big-*$\Omega$ and *big-*$\Theta$ notations. Given two source codes in Java/C++ below, find the time complexity of them in terms of *big-O* notation. 6+4

i)
```
int i,  j = 1;
for(i = 1;i<=n;i++){
        while(j<=m){
                if(a[i]<b[j]){
                        j++;
                }
                else
                        break;
        }
}
```

ii)
```
int i, j, x = 0;
for(i = 1; i<=n ; i=i+1){
        for(j =i;j>=1;j=j/2){
                x ++;
        }
}
```

b) Arrange the following functions of **n** in increasing order of complexity: 4

i) $n^k$ ii) $\sqrt{n}$ iii) n! iv) $n^3$ v) lg n vi) $2^n$

c) Prove that: $31n^3 + 19n + 14 = \Theta(n^3)$ 8

d) Describe Best, Worst and Average case complexity. 3

2. a) Describe two main ingredient for an optimization problem to be suitable for Dynamic Programming. 4

b) Write down a recurrence relation to solve 0 – 1 knapsack problem. Given 4 items with their weight and value, write down the DP table after running the DP algorithm of 0 – 1 knapsack algorithm to fill a knapsack of weight W = 5. Also mention the maximum profit and items taken in the process. 10

| Item | Weight | Value |
|---|---|---|
| 1 | 2 | 10 |
| 2 | 1 | 12 |
| 3 | 3 | 15 |
| 4 | 2 | 20 |

c) Given a set of coins **C** = {$C_1$, $C_2$, … $C_n$} of infinite frequency, where $i^{th}$ coin has value $C_i$ and can be used infinitely many times. Write an efficient algorithm to find whether it is possible to make change of value **M** using at most **K** coins. 8

d) What are the differences between Divide and Conquer and Dynamic Programming? 3

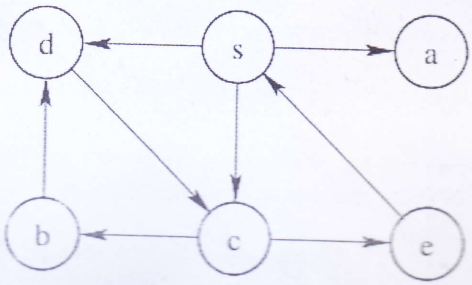
3. a) When and why should we choose a greedy algorithm instead of dynamic programming to solve a problem? 5

b) Given a sequence 0, 8, 4, 12, 2, 10, 6, 14, 1, 9, 5, 13, 3, 11, 7, 15. Calculate the longest increasing subsequence (LIS) from the given sequence. Show all the steps. 8

c) Write down the recurrence relation to solve Longest Common Subsequence (LCS) using Dynamic Programming. Given two sequences P = {M, Z, J, A, W, X, U} and Q = {X, M, J, Y, A, U, Z}, find the LCS value between P and Q. Show all the steps. 2+10

4. a) What is the time complexity of BFS on a graph? What is the time complexity if the graph is a tree? 4

b) Given a directed graph below, find 3+5+5+4




i. BFS tree after traversing the graph starting from vertex **s**.

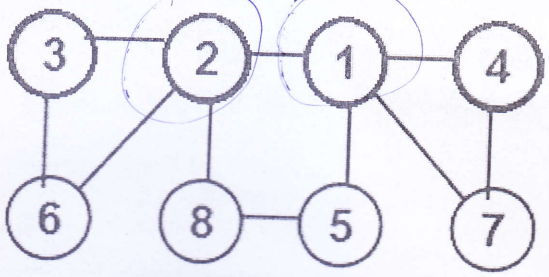
ii. DFS tree after traversing the graph starting from vertex **s**. Also mention the discovery and finishing time of all of the vertices.

iii. Is it a strongly connected graph? If not find all the strongly connected components of the graph.

iv. Classify all the edges of the graph according to DFS traversal.

c) Why Bellman Ford's shortest path algorithm needs V-1 time relaxation of each edge? 4

5. a) What is articulation point and bridge? Given an undirected graph, find low value of each vertex and use low value to find all the articulation points and bridges in the graph. Use vertex 1 as the source to traverse the graph. 2+8




b) Given a 4x4 adjacency matrix of a graph below. Calculate the all pair shortest path of the graph using Floyd-Warshall Algorithm. Show the 4 matrices from 4 steps. 10

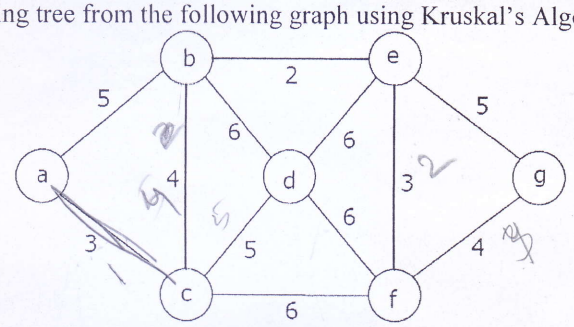
| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 0 | 8 | ∞ | 1 |
| 2 | ∞ | 0 | 1 | ∞ |
| 3 | 4 | ∞ | 0 | ∞ |
| 4 | ∞ | 2 | 9 | 0 |

c) Given the shortest distance matrix **D** of a directed graph computed by Floyd-Warshall algorithm, where $\mathbf{D}_{ij}$ is the shortest distance from vertex **i** to vertex **j**. How can we decide whether the graph 5

contains any positive or negative cycle?

6. a) Describe Adjacency Matrix and Adjacency List in terms of graph representation. Provide an example for both the matrix and the list, such that one is better than another. 6

b) Find minimum spanning tree from the following graph using Kruskal's Algorithm: 10




c) Given a directed graph G = (V, E). Show an O(V) time algorithm to determine whether G contains a universal sink – a vertex with in-degree |V|-1 and out-degree 0. You are given the adjacency matrix already. 9

7. a) Give a simple example of a directed graph with negative weight edges for which Dijkstra's algorithm produces incorrect answers. 5

b) Given an undirected graph G = (V, E). Write an algorithm to find whether the given graph has a unique minimum spanning tree (MST) or not. A minimum spanning tree is unique if there are no other spanning tree in the graph of same cost. 8

c) What is the prefix function π in KMP algorithm? Compute π values for the pattern ***ababbabbabbabbabbababbabb***. 8

d) Explain the worst case running time of Rabin-Karp string matching algorithm with an example. 4

8. a) Describe Fractional Knapsack problem with example. Propose a greedy solution. Describe why greedy algorithm will fail to solve 0 – 1 Knapsack. 6

b) Construct a Huffman code for the following data A = 40, B = 10, C = 20, D = 15 and E = 15, where left side of the equal sign is the symbol and right side is the frequency. Encode ABACABAD using the Huffman code that you have determined. 10

c) In Bellman Ford's Algorithm if the graph can update shortest path value in n-th relaxation iteration, then there is a negative cycle in the graph. Why? Explain with example. 5

d) When can we use Greedy algorithms? 4

# Department of Computer Science & Engineering
## University of Asia Pacific (UAP)

**Final Examination  Spring 2016  2nd Year 2nd Semester**

**Course Code: CSE 231  Course Title: Digital Logic Design  Credits: 3**

**Full Marks: 150  Duration: 3 Hours**

**Instructions:**

1. There are **Eight (8)** Questions. Answer any **Six (6)**. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a) Discuss the universality of NAND gate. 06

   b) Implement the following Boolean function with only NAND gates

   $y = \overline{A}\,B + A\,\overline{B}\,\overline{C}$ 09

   c) Implement the following function using K-map.

   $F(A, B, C, D) = \sum(0, 1, 2, 3, 6, 8, 9, 12, 13, 14, 15)$ 10

2. a) Draw the internal circuit of clocked J-K flip flop and briefly describe its operation. 10

   b) Draw the internal circuit of clocked D flip flop and write down the truth table of the flip flop. 06

   c) Design D flip flop from J-K flip flop. 03

   d) What will be the output of the clocked D flip flop if

   i) $\overline{Q}$ is connected to input?

   ii) Q is connected to input?

   Assume that initially Q = '0'. 06

3. a) Design Half adder and Full adder using K-map or otherwise. 10

   b) Design a BCD adder using IC # 7483 and basic gates if necessary. Briefly describe its operation. 15

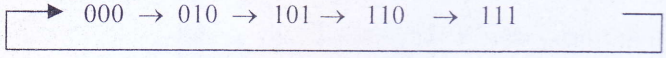
4. a) Draw the internal circuit of IC # 74293 and describe its operation. 10

   b) Design MOD 600 counter using IC # 74293 07

   c) Design MOD 6 ring counter and describe its operation. 08

5. a) What are advantages and disadvantages of synchronous and asynchronous counter? 05

b) Design a synchronous counter that will count the following sequences: 20




6. a) Design a Demultiplexer (DEMUX) by using IC # 74138. 05

b) Design MOD 10 Johnson counter and describe its operation. 10

c) Design a 16-input Multiplexer (MUX) by using IC # 74151. 10

7. a) Implement the function F(A, B, C, D) = ∑(0, 1, 3, 5, 8, 11, 12, 14, 15) using IC # 74151(Multiplexer) and basic gates if necessary. 10

b) Show how IC # 74151 can be used to generate the logic function Z = AB + BC + CA 07

c) Describe the operation of IC # 74138. Design 4 lines to 16 lines decoder using IC # 74138 and basic gates if necessary. 08

8. a) Show how two IC# 74293 can be connected to divide an input frequency by 60 while producing a symmetrical square-wave output? 05

b) For each of the following statements, indicate the type(s) of counter being described: 20

(i) Each FF is clocked at the same time.

(ii) Each FF divides the frequency at its clock input by two(2).

(iii) The counter sequence is 111, 110, 101, 100, 011, 010, 001, 000.

(iv) The counter has ten (10) distinct states.

(v) The total delay is the sum of the individual FF's delay.

(vi) The counter can count in either direction.

(vii) The counter counts from 0 to 9.

(viii) The MOD number is always twice the number of FFs.

(ix) The total delay is the sum of one FF's delay and one AND gate's delay.

( x) The MOD number is always equal to the number of FFs.