University of Dhaka

Department of Computer Science and Engineering

1st Year 2nd Semester B. Sc. Final Examination 2017

CSE-1201: Fundamentals of Programming

Duration: 3 hours **Credits: 3** **Full Marks: 60**

(Answer any four of the following questions)

1. a) Find the output of program below for these inputs (show proper reasoning): 6

   i) 12 13 14 90
   ii) -5 100 3 60
   iii) 80 80 80 60

```
#include <stdio.h>
int main() {
    int x, y, z, T, val;
    scanf("%d %d %d %d",&x,&y,&z,&T);
    if(x<=y){
        if(y>z) val = 2*y - x - z;
        else if(y==z) val = y - x;
        else val = z - x;
    }
    else {
        if(y>z) val = x - z;
        else if(y==z) val = x - y;
        else val = x + z - 2*y;
    }
    if(val>T)printf("%d is below par score\n",val);
    else if (val==T) printf("%d is par score\n",val);
    else printf("%d is above par score\n",val);
    return 0;
}
```

b) Write a code with a loop to print the first 15 Fibonacci numbers. Each number will be separated by a comma and a single space (see the format below). 4

Output Format:

```
0, 1, 1, … , 377
```

c) Write the output of following code (show steps): 3

```
#include <stdio.h>
int main() {
    int a, b = 5, c = 10;
    a= b++ + ++c;
    c= a + b + a & (b|c) / 5;
    printf("%d %d %d\n",a,b,c);
    return 0;
}
```

d) Write the strategies to avoid infinity loop. 2

2. a) Write the output of following code for these inputs 3

i) abcde
ii) a b c
iii) a
b
c

```
#include <stdio.h>
int main() {
    int i;
    char c;
    for (i=1;i<=5;++i) {
        scanf("%c",&c);
        printf("%c -> %d\n",c,c);
    }
    return 0;
}
```

b) Write a code to find the longest common substring in three input strings. The input strings will contain only lowercase English letters. 7

Input	Output
abcab bcabcab caba	cab

c) Write a program which takes N as input and print N lines of following pattern. 5

Input	Output
5	5 151 ~~21512~~ 12121 432151234

3. a) The following function `double divide_by_2 (int num)` is trying to divide a number by 2. Do you think it is correctly implemented? If yes, explain. If not, correct the error and explain. 2

```
double divide(int num)
{
    int divisor = 2;
    return (num/divisor);
}
```

b) Can **main()** function be called recursively? 1

c) What do header files hold? 2

d) Explain call by value and call by reference with a suitable example. 5

e) Write a recursive function to reverse a string. 5

4. a) Write a program for matrix multiplication in c. You will be given the dimensions of the matrices (number of rows and columns) and the values of each cell. 5

b) What are the usage of `const` and `typedef` in c? 3

c) How will you sort a collection of integers and floating point number in descending order? 4

d) Propose a way to return two integers from a function (with example). 3

5. a) Define a structure named **Book** which will contain the following information: 2

```
Name: 30 characters
Author Name: 25 characters
Year of Publish: integer
```

b) What will be the output of **sizeof(struct Book)**? 2
Explain your answer.

c) Create a global array of type: `struct Book`
Now write different functions to perform the following tasks in order:

i) Take information of 10 books as input 1+
ii) Print information of all books which were published in **2015** 1+
iii) Delete all books of Author: **Leo Tolstoy** from the array 3+
iv) Sort all books according to the alphabetic order of their names 3+
v) Store each information of the books in separate text files: 3
`name.txt, author_name.txt, publish_year.txt`

6. a) Write a code which will read a text file and count the followings: 2×4 =8

i) Number of words (Suppose, punctuations are part of words)
ii) Number of whitespaces (single blank space, tab, enter)
iii) Number of Empty lines
iv) Total number of lines

b) Using your knowledge of C programming language, change the syntaxes of the following code as much as possible without changing its I/O such that it becomes impossible to figure out that both codes work with the same input and produces same output. 7
You are free to use anything (functions, macros, structures etc.) as long as it compiles in a C compiler without any error.

```
#include <stdio.h>
int main() {
    int my[10010],oppo[10010],n;
    int t,x,i,j;
    scanf("%d",&t);
    for (x=1;x<=t;++x) {
        int i;
        scanf("%d",&n);
        for (i=0;i<n;++i) scanf("%d",&my[i]);
        for (i=0;i<n;++i) scanf("%d",&oppo[i]);
        int point= 0;
        i= 0; j= 0;
        while (i<n && j<n) {
            int p1= my[i++],p2=2147483640;
            while (j<n) {s
                p2= oppo[j++];
                if (p1>p2) break;
                if (p1==p2) {
                    if (i<n&&j<n&&my[i]<=oppo[j]) {}
                    else break;
                }
            }
            if (p1>=p2) point += (p1>p2) ? 2 : 1;
            if (j>=n) break;
        }
        printf("Case %d: %d\n",x,point);
    }
    return 0;
}
```

University of Dhaka
Dept. of Computer Science and Engineering
1st year 2nd Semester Final Examination, 2017
EEE-1202: Digital Logic Design

Full marks: 60 **Time: 3 hours**

Answer any 4 of the following questions

1. a) Convert the decimal number 295 into a Hex number by division method. Convert this Hex number into binary one. 2

   b) Simplify the following expression using Boolean algebra and realize using NAND gates only $z = \bar{A}C\overline{(\bar{A}BD)} + \bar{A}B\bar{C}\bar{D} + A\bar{B}C$ 4

   c) Determine input conditions needed to produce $z = 0$ in Fig 1. 2

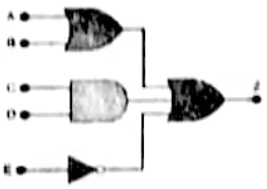


Fig.1

   d) Design and construct a 2 bit multiplier which multiplies two binary numbers $A(A_1A_0)$ and $B(B_1B_0)$. 7

2. a) For a single bit sum, half adder adds 2-bits whereas full adder adds 3-bits. Therefore can we use half adder to implement a full adder? If your answer is yes, design a full adder using half adder for single bit sum. And if your answer is no, state why not. 4

   b) Let the sum of two n-bit numbers $(X_0X_1X_2\ldots X_{n-1})$, $(Y_0Y_1Y_2\ldots Y_{n-1})$ and a carry input C_0 have to be calculated. Determine the generate (G_i) and propagate (P_i) logics for the i-th full adder block of the CLA adder. Find the carry equations for C_3 and C_5. 5

   c) A special kind of encoding technique of some decimal digits is shown below: 6

Decimal	Code
0	0010
1	0100
2	0001
3	0110
4	1001
5	1100
6	1010
7	1011

Show the function table, output equations and the logic (circuit) diagram for the above encoder.

3. a) Mention the difference between a latch and a FF. 3

   b) Determine the Q waveform for a J-K FF with the given input (Fig.2). Assume clock is negative edge triggered and initial value of Q=0. 4

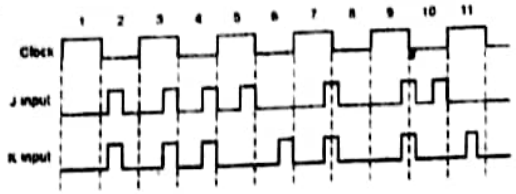


Fig. 2

c) How can we operate an edge triggered D FF in toggle mode? 2
d) Subtract 13 from 7 in 2's complement method using binary format. 3
e) Add two BCD numbers: 738 and 645. 3

4. a) Distinguish between a synchronous and an asynchronous counter. 3
b) How many FFs are required to construct a MOD-115 synchronous counter? How many AND gates are required for it? How many inputs are required for the last AND gate? What is the input of the NAND gate? 4
c) Draw a MOD-10 asynchronous counter. 3
d) Draw a CMOS NAND gate and explain it's truth table. 5

5. a) Mention the advantages of MOSFET. 2
b) Determine fan-out of 74LS gate using table-1. 2

	Outputs		Inputs	
TTL Series	I_{OH}	I_{OL}	I_{IH}	I_{IL}
74	−0.4 mA	16 mA	40 μA	−1.6 mA
74S	−1 mA	20 mA	50 μA	−2 mA
74LS	−0.4 mA	8 mA	20 μA	−0.4 mA
74AS	−2 mA	20 mA	20 μA	−0.5 mA
74ALS	−0.4 mA	8 mA	20 μA	−0.1 mA
74F	−1 mA	20 mA	20 μA	−0.6 mA

Table 1: 74 series characteristics

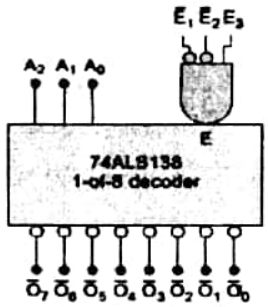


Fig. 3

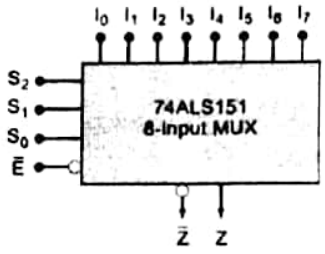


Fig. 4

c) How many input and output lines are required for a 1-of-200 decoder? How many input, output and selector lines are required for a 1-of-200 multiplexer? How many input and output lines are required for a octal to binary encoder? 4
d) Construct a 1-of-16 decoder using 74LS138(Fig.3) ICs. 3
e) Design a 1-of-16 multiplexer using the 74LS151 (Fig.4) ICs. 4

6. a) Describe the internal architecture of a ROM that stores 4K bytes and uses a square register array. 3
b) Distinguish between SRAM and DRAM. 5

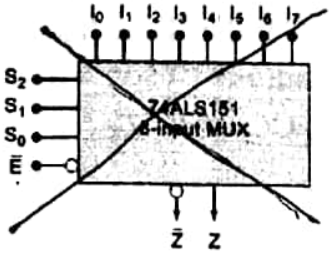
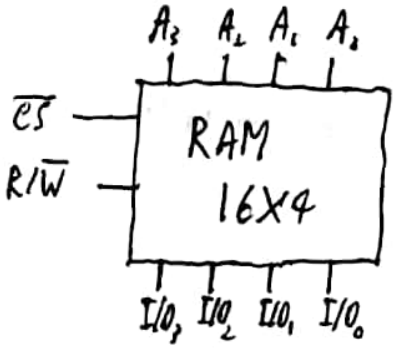


Fig. 5



c) We want to combine several 16 × 4 ROM (Fig.5) chips to produce a total capacity of 64×48. How many ROM chips are needed? How many address bus lines are required? How can we select different chips? Show the connections of chip selector lines. 7

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Department of Computer Science and Engineering

1st Year 2nd Semester B. Sc. Final Examination 2017

CHE-1203: Chemistry

Duration: 3 hours **Credits: 3** **Full Marks: 60**

(Answer any four of the following questions)

1. a) Arrange the following radiation according to their increasing wavenumber: radiowave, X-ray, infrared, ultraviolet, γ-ray, and microwave radiation. 1

   b) According to Heisenberg uncertainty principle, $\Delta x \Delta p \geq {}^{h}/_{4\pi}$. What do Δx and Δp stand for? What is the significance of the sign '≥' here? 1+1

   c) Which of the following sets of quantum number is permissible? Justify your answer. 2
      i) $n = 2, l = 1, m = +1, s = +1/2$
      ii) $n = 2, l = 2, m = +1, s = +1/2$

   d) Define orbital. Draw the shapes of the following orbitals: $4d_{x^2-y^2}, 3d_{xy}, 3d_{z^2}$ and $2p_y$. 1+2

   e) How many orbitals are there in the subshells (i) 4p, (ii) 3d, (iii) 2s and (iv) 5f? 2

   f) Calculate the wavelength of a photon (in nanometers) emitted by a hydrogen atom during transition from the $n_f = 5$ energy state to $n_f = 3$ energy state. Given: Rydberg constant, R_H is 2.18×10^{-18}J, Planck constant, $h = 6.626 \times 10^{-34}$J.s. 3

   g) Write down the electronic configuration of the following species Fe^{2+}(26), Cr(24), Zn(30), Ar(18) 2

2. a) State the modern periodic law. Classify the elements as representative element, transition metal, noble gas, or none of these: K, Xe, Cd and Ni. 1+2

   b) Define *ionization energy*. Explain the very low values of ionization energies associated with Group I elements. 1+2

   c) Be and Al have similarity in chemical behavior. Explain. 3

   d) Sodium chloride, aslo known as table salt, is a typical compound, a brittle solid with high melting point (801°C) that conducts electricity in the molten state and in aqueous solution. 2+1+1
      i) What type of bonding is there in NaCl? Show how octet rule is applied in the formation of bonding in NaCl.
      ii) Justify the mentioned properties of NaCl.
      iii) What is wrong with or ambiguous about if one states "four molecules of NaCl"? Define *molecule*.

   e) Show different bondings present in NH_4Cl. 2

3. a) Graphically show the distribution of molecular speeds of O_2 molecules at 25°C and 50°C. 3

   b) How can you prepare a buffer solution? 2

   c) i) Write the Henderson-Hasselbalch expression for a buffer system containing CH_3COOH and CH_3COONa. 2+3+2
      ii) If $[CH_3COOH] = 0.5$ M and $[CH_3COONa] = 0.52$ M, calculate the pH of this buffer. $pK_a = 9.74$
      iii) If you add a little amount of HCl to this buffer, how will it act to maintain the pH?

d) In cold weather areas, an antifreeze liquid is usually added to the liquid fuel of cars. Which of the colligative properties can you relate to this practical practice? 1

e) At 27°C, 5.0 moles of a gas in a 2.0L container exerts a pressure of 100 atm. Is it an ideal gas? 2

4. a) What are real and ideal gases? 2

b) Explain why pressure exerted by 1 mol of NH_3 in a 1L vessel at 300K is less than that exerted by 1 mol N_2 in a vessel of the same volume and also at 300K. 2

c) What is compression factor? 1

d) Write down Van der Waals equation explaining different terms in it. What are the significance of Van der Walls constants for a and b? 3

e) Draw distribution curves for molecular velocities at two different temperatures for a gas. Identify the characteristic features of the distribution curves and the effect of increasing the temperature on the molecular velocities. 3

f) What is triple point? Draw the phase diagram of water and locate triple point in it. What is the degree of freedom of water at the triple point? 1+2 +1

5. a) State the first law of thermodynamics. Why is *enthalpy* called a state function? 1+1

b) How is free energy change related to equilibrium constant of a reaction? 2

c) Calculate the standard enthalpy of formation of carbon monoxide (CO). 3

$$C\ (graphite) + \tfrac{1}{2}O_2(g) \rightarrow CO(g)$$

Given: $C\ (graphite) + O_2(g) \rightarrow CO_2(g) \quad \Delta H^o_{rxn} = -393.5\ kJ/mol$

$$CO(g) + \tfrac{1}{2}O_2(g) \rightarrow CO_2(g) \quad \Delta H^o_{rxn} = -283.0\ kJ/mol$$

d) Why the equilibrium yield of NH_3 in the reaction 3

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g), \quad \Delta H = -92\ kJmol^{-1}$$

decreases, if the reaction temperature is varied.

e) Write down the rate expressions and rate equation for the reaction 2

$$aA + bB = cC + dD$$

f) The decomposition of methane to methyl radicals is a first-order reaction with a rate constant $5.36 \times 10^{-4} s^{-1}$ at 700°C. $C_2H_6(g) \rightarrow 2CH_3(g)$. Calculate the half-life of the reaction. 2

g) Write down Arrhenius equation to correlate reaction rate with temperature. 1

6. a) Define solution. You are given three sugar solutions: saturated, unsaturated and supersaturated. How can you distinguish them using a crystal of sugar? 3

b) What are colligative properties? Why are they so called? 3

c) With the help of appropriate vapor-pressure-temperature curves, show that the freezing point of a solvent is depressed by a dissolved non-volatile solute. 2

d) Write the cell reaction and electrode half-reactions for the following cell: 2

$Zn(s) \mid Zn^{2+}(aq) \parallel Hg^{2+}(aq) \mid Hg(l)$

e) What is liquid junction potential? What is the criterion for selecting a salt for a salt bridge? 2

f) What is an electrolytic cell? 2

g) Name two polymerization processes used for preparation of conventional polymers. 1

University of Dhaka

Department of Computer Science and Engineering

1st Year 2nd Semester Examination 2017

MATH 1204: Methods of Integration, Differential Equations and Series

Marks 60 **Time: 3 Hours**

Answer any 4 of the following questions

1 a) Evaluate the following integrals: 6

i) $\int \frac{2x+4}{x^3-2x^2}dx$ ii) $\int_1^3 \sqrt{x}\ \tan^{-1}\sqrt{x}\ dx$

b) Define Gamma function. Use Gamma function to show that 4

$$\int_0^1 (\ln x)^n\, dx = (-1)^n\ \Gamma(n+1); n > 0$$

c) Find the area of the surface that is generated by revolving the portion of the curve $y = x^2$ between $x = 1$ and $x = 2$ about the y-axis. 5

2 a) Sketch graph of the equations $r^2 = \cos 2\theta$ and $r = 3(1 + \sin\theta)$ in polar coordinates. 5

b) Find the area of the region that is common to the circle $r = 2\sin\theta$ *and* $r = 2\cos\theta$. 5

c) Find the surface area generated by revolving the curve $x = \sqrt{9 - y^2}, -2 \le y \le 2$ about the y-axis. 5

3 a) Define Ordinary Differential Equation (ODE), order and degree of an ODE. Determine the order and degree of the following ODEs. Also mention which of these equations are linear or nonlinear in y with proper reasoning. 6

i) $(y - x)dx + 4xy\,dy = 0$ *ii)* $x^3\frac{d^3y}{dx^3} + x\left(\frac{dy}{dx}\right)^3 - 5y^2 = e^x$ *iii)* $\frac{d^2y}{dx^2} + \tan x = 0$

b) What do you mean by exact differential equation? Determine whether the equation $\left(\frac{3-y}{x^2}\right)dx + \left(\frac{y^2-2x}{xy^2}\right)dy = 0$ is exact. Hence solve it using appropriate method with an initial condition $y(-1) = 2$. 4

c) Write the standard expression for first order linear equation. Solve the following first order linear equation, $x\frac{dy}{dx} + \frac{2x+1}{x+1}y = x - 1$. 5

4 a) A model for the population $P(t)$ in a suburb of a large city is given by the initial-value problem, $\frac{dp}{dt} = P\,(10^{-1} - 10^{-7}P), P(0) = 5000$, where t is measured in months. What is the limiting value of the population? At what time will the population be equal to one-half of this limiting value? 7

b) Write the difference equation for improved Euler's method. Explain the idea of this method geometrically. Use improved Euler's method to obtain the approximate value of $y(1.5)$ for the solution of the initial-value problem $y' = 2xy, y(1) = 1$; taking $h = 0.1$. 8

5 a) Define sequence. Give example of strictly increasing, strictly decreasing, increasing but not strictly and decreasing but not strictly sequence. 4

b) Show that the sequence $\left\{\frac{|x|^n}{n!}\right\}_{n=1}^{\infty}$ converges and find its limit. 5

c) State the integral test. Use the test to discuss the convergence of the p-series, $\sum_{k=1}^{\infty}\frac{1}{k^p}$. 6

6 a) Find the Taylor series about $x = \frac{\pi}{2}$ for $cos\ x$ and also find Maclaurin series for $cos\ x$. 6

b) Find the Taylor series for e^x about $x = 1$ and show that the series converges to e^x for all x. 5

c) Find the interval of convergence and radius of convergence of the following power series: 4

i) $\sum_{k=0}^{\infty} \frac{x^k}{k!}$, ii) $\sum_{k=0}^{\infty} k!\, x^k$.