

University of Dhaka
Department of Computer Science and Engineering
1st Year 2nd Semester Final Examination, 2019
CSE 1201: Fundamentals of Programming

Total Marks: 70

Time: 3 Hours

Answer any 5 (five) of the following questions

1. (a) Assume, $y = 3$ and $z = 5$. You are given an expression in C++:

$$x = y + z/2$$

Write the value of x for each of the following cases. [4]

- i. x, y, z are all int.
 - ii. x, y, z are all double.
 - iii. x is double and y, z are int.
 - iv. x, y are double and z is int.
- (b) Write a program, that will take two integers A and B as input. It will also take a character C as input. Value of C will be '+', '-' or '*'. Your program should output the result of the operation (based on the value of C) on A and B. See examples for clarification. [6]

Example Input	Expected Output
1 2 +	1 + 2 = 3
1 2 *	1 * 2 = 2

- (c) Assume that you have only one data type in your programming language which is int (32 bit signed integer). You need to write a program which will take two non-negative floating point numbers as input and add them. You may assume that in both the numbers, the part before decimal point will be less than or equal to 10^9 . There will be exactly six digits after that decimal point in both numbers. While producing output, you can't print leading/trailing zeroes. See examples for clarification. [4]

Example Input	Expected Output
1.005000 2.100000	3.105
1.500000 5.500000	7

2. (a) Write a function in C/C++ that takes an integer as argument and returns true if the number can be expressed as a summation of two prime numbers otherwise returns false. [5]
- (b) You are probably quite familiar with image flipping. All images are actually two dimensional arrays where each cell holds a certain rgb value. Write a program that can perform similar operation on a square matrix i.e. flip the matrix horizontally. [4]

1	2	3	4		4	3	2	1
5	6	7	8	After Flipping	8	7	6	5
9	10	11	12	→	12	11	10	9
13	14	15	16		16	15	14	13

You should write necessary code to take input of an $n \times n$ matrix first. Also print minor diagonal of the matrix before and after flipping; for the above example, which is 4, 7, 10, 13 and 1, 6, 11, 16 before and after flipping, respectively.

- (c) Show step by step simulation of the following C program and write console output for input:
num1 = 36 and num2 = 69. [5]

```
#include <stdio.h>
int main(){
    int i, num1, num2, num3, value=1;
    scanf("%d%d",&num1,&num2);
    printf("num1=_%d_and_num2=_%d\n",num1, num2);
    if(num1 == 0) printf("%d\n",num2);
    else if(num2 == 0) printf("%d\n", num1);
    else{
        if(num1<num2){
            num3 = num1;
            num1 = num2;
            num2 = num3;
            printf("num1=_%d_and_num2=_%d\n", num1, num2);
        }
        for(i=0;;i++){
            if(num2 == 0) break;
            num1 = num1 + num2;
            num2 = num1 - num2;
            num1 = num1 - num2;
            num2 = num2 % num1;

            printf("In loop[%d]:_num1=_%d_and_num2=_%d\n",
                    i, num1, num2);
        }
        printf("result=_%d\n", num1);
    }
    return 0;
}
```

*Note that, _ indicates space.

3. (a) Write the content of the array **a** after each of the execution in line 2, 3, 4 and 5. [4]

```
1  int a[5] = {1, 2, 3, 4, 5}, i;
2  for(i=0; i<5; i++) a[i] = a[i] - 1;
3  for(i=0; i<5; i++) a[i] = a[i] - a[i] / 2;
4  for(i=0; i<5; i++) a[i] = a[i] + a[i] * 2;
5  for(i=0; i<5; i++) a[i] = a[i] - a[i] / 2;
```

- (b) Write a program which will take an integer N and array with N integers as input. The program will also take another integer X as input and find the maximum value in the array which is less than X. See example for clarification. [6]

Example Input	Expected Output
5	4
3 4 1 6 15	
5	

- (c) You will be given an array of even integers with N elements. You will need to find the median of the array for each index I, considering the prefix of the array till I. Your program will be

evaluated based on it's efficiency. Note that median of an array is the middle element (or average of the middle two elements in case there are even number of elements) if the array is sorted. See example for clarification. [4]

Example Input	Expected Output
5 10 4 8 6 100	10 7 8 7 8

4. (a) Suppose you and your friends play an interesting game called "Read it reverse, if you can". In this game, every player have to read a document which is written in English but the words in each line are in reverse form. Write a program that takes a text file as input and write down the output in another text file after fixing the lines. See examples for clarification. [5]

Example Input	Expected Output
iH	Hi
I ma reteP.	I am Peter.
I evil ni akahD dna yduts ta ESC tped.	I live in DHaka and study at CSE dept.

- (b) You will be given a string S. You need to add minimum number of characters at the end of S to make it a palindrome. Your program will be evaluated based on its efficiency. See examples for clarification. [5]

Example Input	Expected Output
abc	abcba
abbab	abbabba

- (c) Write a program that accepts a string of of ASCII characters and finds the first recurring character (character which has earliest second occurrences in the list) in it. Note that you are not allowed to use nested loop or recursive function in your solution for this problem. See examples for clarifications. [4]

Example Input	Expected Output
bdafhadjf	a
asdfghjk	No recurring character

5. (a) What are the benefits of using structures? Explain with examples. [4]
- (b) Define the following functions with appropriate return type and relevant bodies: [6]
- **findMinIndex(int a[], int st, int ed)**: this function returns the index of a[] which has the minimum value between the indices st and ed (inclusive).
 - **sort(int a[])**: this function sorts the array a[], using the function **findMinIndex()**.
- (c) Write a function which will generate all the combinations if R integers are taken from the set consisting of all the integers from 1 to N. You will be given the input of N and R. See examples for clarification. [4]

Example Input	Expected Output
4 3	1 2 3 1 2 4 1 3 4 2 3 4

U

6. (a) Why would you use functions? Write its benefits with proper examples. [4]
- (b) Write a program which will define a structure Student with members: Name, Roll, Marks and CGPA. Your program will take information of N students into that structure and sort them according to CGPA. If two students have the same CGPA, then they will be sorted based on Marks. Print the sorted order. [6]
- (c) Write a program which will take two filenames as input and compare the contents. It will output one of the following based on the results of the comparisons: [4]
- i. **Accepted:** if the contents of both files are exactly same.
 - ii. **Whitespace Error:** if the contents of the both files are same, when the whitespace characters (space, tab, newline) are ignored.
 - iii. **Wrong Answer:** for every other kind of mismatches.
7. (a) Write the benefits of files in C/C++ programming using appropriate examples. [4]
- (b) Write a function `sortThreeInts(int *x, int *y, int *z)` which sorts three integers. Use proper parameters and return type. You can't use array or loop. The function should be called from and also the output should be printed in `main()`. [6]
- (c) You are given N different rocks with different weights. The weight of the i-th rock is W_i . You need to divide the rocks in two different piles, such that summation of the weights of each pile is equal. Assume that the weights can be as big as 10^9 , N will be at most 20. Your program will be evaluated based on its efficiency. [4]

54
69

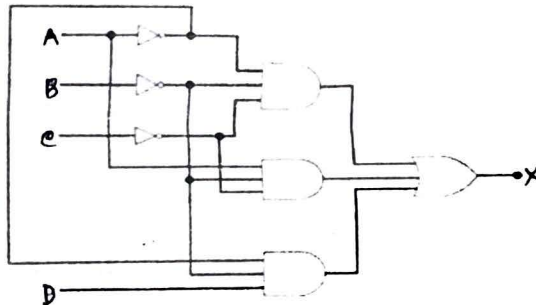
University of Dhaka
Department of Computer Science and Engineering
1st Year 2nd Semester B.Sc. Final Examination – 2019
EEE-1202: Digital Logic Design

Time: 3.00 Hours

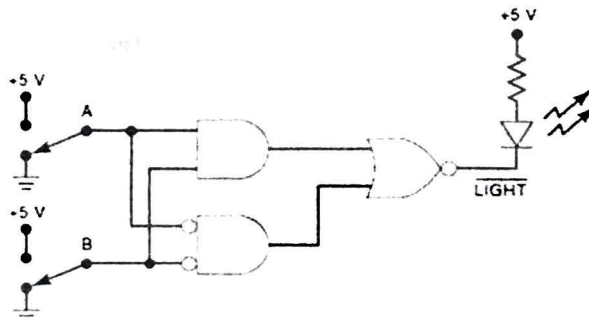
Total Marks: 70

[Answer any 5 of the following 7 Questions]

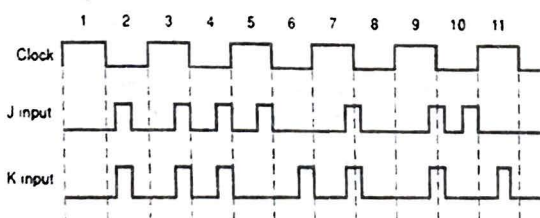
1. a. In a microcomputer, the addresses of memory locations are binary numbers that identify each memory circuit where a byte is stored. The number of bits that make up an address depends on how many memory locations there are. Since the number of bits can be very large, the addresses are often specified in hexadecimal instead of binary. [4]
- i) If a microcomputer uses a 20-bit address, how many different memory locations are there?
- ii) How many hexadecimal digits are needed to represent the address of a memory location?
- b. Computers often communicate with other remote computers over telephone lines. For example, this is how dial-up communication over the internet takes place. When one computer is transmitting a message to another, the information is usually encoded in ASCII. What actual bit strings would a computer transmit to send the message HELLO, using ASCII with even parity system? [3]
- c. Write the Boolean expression for output x in the following figure. Determine the value of x for all possible input conditions, and list the values in a truth table. [3]



- d. The following figure shows an application of logic gates that simulates a two-way switch such as the ones used in our homes to turn a light on or off from two different switches. Here, the light is an LED that will be ON (conducting) when the NOR gate output is LOW. Note that this output is labeled to indicate that it is active-LOW. Determine the input conditions needed to turn on the LED. [4]

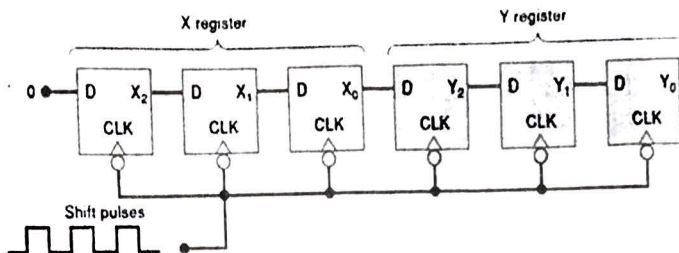


2. a. Briefly explain DeMorgan's theorems those are extremely useful in simplifying expressions in which a product or sum of variables is inverted. [2]
- b. Simplify each of the following expressions [3]
- $y = \overline{(C + D)} + \overline{A}CD + \overline{A}B\overline{C} + \overline{A}BCD + AC\overline{D}$
 - $x = AB(\overline{C}D) + \overline{A}BD + \overline{B}C\overline{D}$
- c. Consider that you have to design a logic circuit that has four inputs (ABCD) and one output (Z), where Z will be High whenever either A = B = 1 or C = D = 1, for all other cases Z will be Low or Zero. Write the truth table considering the above. Simplify the expression using K-map and draw the simplified logic circuit. [5]
- d. A Binary Coded Decimal (BCD) code is being transmitted to a remote receiver. The bits are A3A2A1A0 with A3 as the Most Significant Bit (MSB). The receiver circuitry includes a BCD error detector circuit that examines the received code to see if it is a legal BCD code (i.e. ≤ 1001). Design this circuit to produce a HIGH output for any error condition. [4]
3. a. Briefly explain the operation of a Full-adder with truth table, logical expression and circuit. Distinguish between binary addition and OR addition. [4]
- b. Briefly explain the operation of a 4-bit serial adder. How it differs with 4-bit parallel adder. [5]
- c. What is full subtraction? Explain the operation of a 4-bit 2's complements adder/subtractor circuit using control input that selects adder or subtraction input. [5]
4. a. Define decoder and encoder. Explain the operation of a decoder with 3 inputs and 8 outputs. [5]
- b. Why DAC and ADC conversions are required in real world application? Briefly explain the operation of a simple DAC using an op-amp summing amplifier with binary-weighted resistors. [6]
- c. What do you understand by resolution D/A converter? What happens if you increase or decrease it? What are the effects of quantization errors in case of A/D conversion? [3]
5. a. The waveforms shown in the following figure are to be applied to two different FFs: [5]
- positive-edge-triggered J-K
 - negative-edge-triggered J-K
- Draw the Q waveform response for each of these FFs, assuming Q = 0, initially. Assume that each FF has zero holding time.

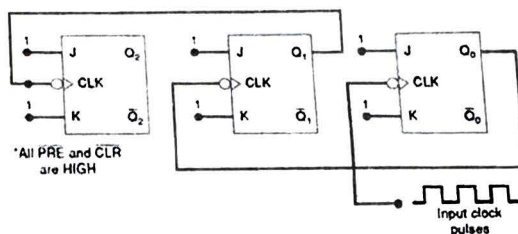


- b. Draw a circuit diagram for the synchronous parallel transfer of data from one 3-bit register to another using J-K flip-flops. [4]

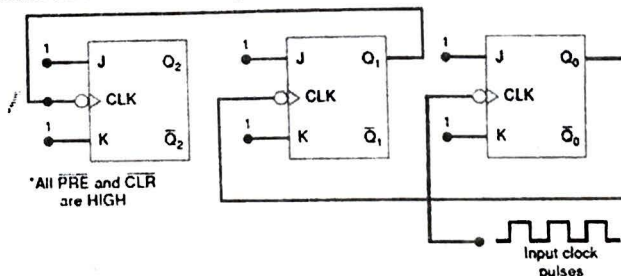
- c. Refer to the following figure where a 3-bit number stored in register X is serially shifted into register Y. How can the circuit be modified so that, at the end of the transfer operation, the original number stored in X is present in both registers? [5]



6. a. Consider a counter circuit that contains six J-K flip-flops wired in the (extended) arrangement of the following figure (i.e., Q5, Q4, Q3, Q2, Q1, Q0). [5]



- Determine the counter's MOD number.
 - Determine the frequency at the output of the last FF (Q5) when the input clock frequency is 1 MHz.
 - What is the range of counting states for this counter?
 - Assume a starting state (count) of 000000. What will be the counter's state after 129 pulses? [29]
- b. Refer to the binary counter of the following figure. Change it by connecting $\overline{Q_0}$ to the CLK of flip-flop X_1 , and $\overline{Q_1}$ to the CLK of flip-flop X_2 . Start with all FFs in the 1 state, and draw the various FF output waveforms (X0, X1, X2) for 16 input pulses. Then list the sequence of FF states. Draw the state transition diagram for this counter. [5]



- c. Draw the circuit diagram for a MOD-16 synchronous counter and explain its operation. [4]
7. a. What are memory devices? Explain memory hierarchy considering closeness to CPU, cost per/unit, access time and capacity. [4]
- b. What are cache memories? What happens if cache misses occurs? Briefly explain the policies and mechanisms for removing or evicting current occupants from cache. [6]
- c. Explain the architecture of a 16×8 ROM where each register stores one 8-bit word. [4]

1st Year 2nd Semester B. Sc. Final Examination, 2019
Department of Computer Science and Engineering
University of Dhaka
CHE 1203: Chemistry

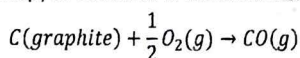
Total Marks: 70

Time: 3 Hours

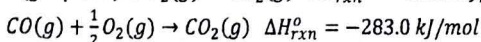
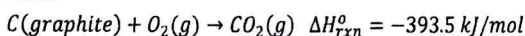
(Answer any Five (5) of the following Questions)

1. a) State Planck's theory of quantization of energy in your own words. 2
b) Define orbital. 4f orbital exists, but not 3f. Explain briefly. 2
c) What is the notation for the subshell in which $n = 4, l = 2$? How many orbitals are there in the subshell in which $n = 4$? 2
d) Calculate the wavelength of a photon (in nanometers) emitted by a hydrogen atom during transition from the $n_i = 6$ energy state of $n_f = 4$ energy state. The value of Rydberg constant, R_H is $2.18 \times 10^{-8} \text{ J}$. 2626 nm 4
e) State Hund's rule of maximum multiplicity. 2
f) Electron configuration of Fe is $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$. When Fe is oxidized to Fe^{2+} , which of the following electron configurations would be correct? Why? 2
i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^2$ ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^0$
2. a) Henry Moseley discovered a correlation between atomic number and the frequency of X rays generated by bombarding an element with high-energy electrons. How did it help to establish modern periodic law. 3
b) What is electron affinity? Point out similarities and dissimilarities between electron affinity and electro-negativity. 2
c) Explain the general increases in values of ionization energies, as we go across a period. 3
d) Classify the type of bonds in the following compounds with proper reasoning: HCl, KF, NH_3 , NH_4Cl . 2
e) Classify the following materials as metal, non-metal and metalloids: copper, carbon, silicon, mercury. 2
f) What is the general electron configuration of noble gases? Name two compounds formed by Xenon. 2
3. (i) Calculate the ΔG^0 for the following reaction at the standard state; 2
 $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \leftrightarrow 2\text{HBr}(\text{g})$ [$\Delta G^0_{\text{f}(\text{HBr})} = -53.2 \text{ kJ mol}^{-1}$]
ii) Comment on the spontaneity of the forward process of this reaction. 2
b) How does the rate constant of a reaction vary with temperature? 2
c) i) Write the expression for K_p for the reaction $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \leftrightarrow 2\text{HI}(\text{g})$ 2
ii) How is K_p related to K_c for this reaction? 1
iii) In one experiment, a mixture of 1.0 mol of H_2 and 1.0 mol of I_2 are placed in a 1.0 L flask at 430°C . Calculate the equilibrium concentrations of H_2 , I_2 and HI at this temperature. (K_c at $430^\circ\text{C} = 54.3$) 1.572, 0.214, 0.219 3
iv) How will the equilibrium shift if you increase the reaction temperature? (consider the reaction to be exothermic) 2
4. a) Write the ideal gas equation and state it in words. Give the units for each term in the equation. 2
b) Write van der Waals equation for a real gas. Explain corrective terms for pressure and volume. 3
c) Ammonia has a larger a value than neon does. What can you conclude about the relative strength of the attractive forces between molecules of ammonia and between atoms of neon? 2
d) 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
e) 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? 4

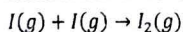
5. a) Define solution. You are given three sugar solutions: saturated, unsaturated and supersaturated. How can you distinguish them using a crystal of sugar? 3
- b) Predict the relative solubilities in the following cases: (i) Bromine (Br_2) in benzene and in water, (ii) KCl in carbon CCl_4 and in liquid ammonia, (iii) formaldehyde in carbon disulfide and in water. 3
- c) What are colligative properties? What is the meaning of the word "colligative" in this context? 3
- d) 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. 3
- e) Write the equation relating osmotic pressure to the concentration of a solution. Define all the terms and specify their units. 2
6. a) State the first law of thermodynamics. Which of the following thermodynamic functions are associated only with the first law of thermodynamics: S, E, G, and H? 2
- b) Which of the following processes are spontaneous and which are nonspontaneous? (i) dissolving table salt (NaCl) in hot soup; (ii) climbing Mt. Everest; (iii) spreading fragrance in a room by removing the cap from a perfume bottle; (iv) separating helium and neon from a mixture of gases. 2
- c) Calculate the standard enthalpy of formation of carbon monoxide (CO). 3



Given:



- d) Why the equilibrium yield of NH_3 in the reaction 3
- $$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}), \Delta H = -92 \text{ kJ/mol}$$
- decreases, if the reaction temperature is varied.
- e) Write down the rate expressions in different form and rate equation for the reaction 2
- $$aA + bB \rightarrow P$$
- f) Iodine atoms combine to form molecular iodine in the gas phase 2



This reaction follows second-order kinetics and has the high rate constant 7.0×10^9 /M.s at 23°C . Calculate the half-life of the reaction if the initial concentration of I is 0.50 M.

7. a) What is the difference between a galvanic cell and an electrolytic cell? 2
- b) Suppose a galvanic cell consists of a zinc and a Gold electrodes having standard reduction potentials at 25°C as -0.76 V and $+1.50 \text{ V}$, respectively, 2
- i) What is the meaning of 'standard reduction potential' here? 2
- ii) What will be the direction of flow of current if the two electrodes are connected by an external circuit and what will be the standard cell emf? 2
- c) What is the role of hydrogen bonding in maintaining the double helix structure of DNA? 2
- d) What is a peptide bond? Where is it most commonly found? 3
- e) How can you classify carbohydrate based on their reactivity? Define and give example of each type. 3

1st Year 2nd Semester B. Sc. Final Examination, 2019

Department of Computer Science and Engineering

University of Dhaka

MATH 1204: Methods of Integration, Differential Equations and Series

Total Marks: 70

Time: 3 Hours

(Answer any Five (5) of the following Questions)

1. a) Evaluate any two of the following indefinite integral. 8

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

- b) Sketch the region enclosed by the curves $x = \sin y$, $x = 0$, $y = \pi/4$, $y = 3\pi/4$ and find its area 6

2. a) Find the exact arc length of the curve $24xy = y^4 + 48$ from $y = 2$ to $y = 4$. 5

- b) Calculate the area of the surface of revolution obtained by revolving the curve $y = (1/3)(x^2 - 2)^{3/2}$ from $x = 1$ to $x = 4$ about the y -axis. 5

- c) Find the volume of the solid generated by revolving the plane region bounded by $y = x^2$, $y = 9$, and $x = 0$ about the y -axis 4

3. a) Find the area lying above the x -axis and included between the parabola $y^2 = ax$ and the circle $x^2 + y^2 = 2ax$. 7

- b) Find the length of the perimeter of the cardioid, $r = a(1 + \cos \theta)$. 7

4. a) State the existence and uniqueness theorem. Does the differential equation 4

$$\frac{dy}{dx} = x^2 \sin y; y(1) = 2$$

have a unique solution? Justify your answer.

- b) Solve the following differential equations. 10

i) $(x^2 + y^2 + 1)dx - 2xydy = 0$

ii) $(x + 2y - 4)dx + (2x + y - 5)dy = 0$

5. a) Sketch the graphs of the parabola $y^2 + 8x = 0$ and show the focus and directrix. 7

- b) Find the constants a , b , and c for the ellipse, $r = \frac{6}{2+\cos \theta}$ and sketch the graph. 7

6. a) Define improper integral. Prove that $\int_1^\infty \frac{1}{x^p} dx = \begin{cases} \frac{1}{p-1} & \text{if } p > 1 \\ \text{diverges,} & \text{if } p \leq 1 \end{cases}$ 5 7

- b) Define sequence and convergence of a sequence. Determine whether the sequence converges or diverges by examining the limit as $n \rightarrow +\infty$ 5 7

i) $\left\{ \frac{n}{2n+1} \right\}_{n=1}^{+\infty}$ and ii) $\left\{ (-1)^{n+1} \frac{1}{n} \right\}_{n=1}^{+\infty}$

7. a) Compute the Maclaurin series of $f(x) = \sin(x)$ in its generalized form and find the radius of convergence. 7

- b) Define Taylor infinite series. Find the Taylor series for $f(x) = \ln(x)$ about $x = 2$. 7

$$A = \int_c^d 2\pi x \sqrt{1 + (dx/dy)^2} dy$$