

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
1st Year 1st Semester B.Sc. (Engg.) Final Examination-2022
Department of Computer Science and Engineering
ENG 1109: English (3 Credits)

Time: 3 Hours

Full Marks: 70

Figures shown in the right margin indicate full marks.
 Answer **07** out of **09** questions.

1 Read the following extract and answer the questions below:

Psychologically there are two dangers to be guarded against in old age. One of these is undue absorption in the past. It does not do to live in memories, in regrets for the good old days, or in sadness about friends who are dead. One's thoughts must be directed to the future, and to things about which there is something to be done. This is not always easy; one's own past is a gradually increasing weight. It is easy to think to oneself that one's emotions used to be more vivid than they are, and one's mind more keen. **If this is true it should be forgotten, and if it is forgotten it will probably not be true.** The other thing to be avoided is clinging to youth in the hope of sucking vigour from its vitality. Animals become indifferent to their young as soon as their young can look after themselves, but human beings, owing to the length of infancy, find this difficult.

Some old people are oppressed by the fear of death. In the young there is a justification for this feeling. Young men who have reason to fear that they will be killed in battle may justifiably feel bitter in the thought that they have been cheated of the best things that life has to offer. But in an old man who has known human joys and sorrows, and has achieved whatever work it was in him to do, the fear of death is somewhat abject and ignoble. The best way to overcome it -so at least it seems to me- is to make your interests gradually wider and more impersonal, until bit by bit the walls of the ego recede, and your life becomes increasingly merged in the universal life. An individual human existence should be like a river: small at first, narrowly contained within its banks, and rushing passionately past rocks and over waterfalls. Gradually the river grows wider, the banks recede, the waters flow more quietly, and in the end, without any visible break, they become merged in the sea, and painlessly lose their individual being.

- | | | |
|----|---|---------|
| a. | Identify the type of write-up of the context. Explain using instances from the extract. | 3 |
| b. | Critically explain the 'river metaphor' in your own words. | 3 |
| c. | Comment on the bold sentence of the extract based on your understanding of the whole passage. | 4 |
| 2 | Answer any one of the following: | |
| a. | Evaluate the key factors to building great professional relationship. | 10 |
| b. | What are the differences between a CV and a resume? Discuss how you can avoid committing silly mistakes during an electronic communication. | 3+7 |
| 3 | Write a paragraph on any one of the following: | |
| a. | Living Through Pandemic | |
| b. | Suicidal Tendency among Students of Bangladesh | |
| c. | Abuses of Artificial Intelligence (AI) | |
| 4 | Identify the grammatical and structural errors in the following extracts and rewrite them in correct forms (any ten): | 10×1=10 |
| a. | Hasan said me that his father was sick. | |
| b. | Everybody say that life is a struggle. | |
| c. | Do you know who is this boy? | |
| d. | Sarah is getting married with my friend. | |

- e. *Harry Potter* is one of my favorite character.
 - f. Has he took his phone with him?
 - g. I am waiting here since 3.30 pm.
 - h. He didn't finish his homework yet.
 - i. I arrived in the airport on a car.
 - j. The agency shared the informations.
 - k. That is best food I have ever had in my life.
 - l. The minister, along with his secretary, are going to visit the location.
- 5 Write a formal email using the open punctuation method (*any two*): 5×2=10
- a. Write a congratulating message to your boss (Chief Engineer) regarding her recent achievement at an international conference.
 - b. Suppose, you are the Customer Service Manager of a parcel delivery agency. Write a formal apology mail to a customer of your company regarding a delayed delivery of items.
 - c. Suppose, a junior employee of your organization has just lost his grandfather. Write a formal condolence mail to him on behalf of your company.
- 6 Write short notes on the following (*any two*): 5×2=10
- a. Unity and Coherence
 - b. Gesture and Posture
 - c. Five components of communication
- 7 Write a precis on the following passage: 10
- Advancements in technology are reshaping the landscape of work, presenting both opportunities and challenges for individuals and organizations. A research paper by a team of economists investigates the impact of automation on employment patterns. The findings suggest that automation is likely to replace certain routine tasks, leading to job displacement in some sectors. However, the study also highlights the emergence of new job opportunities that require human skills such as creativity, critical thinking, and emotional intelligence. The authors argue that adapting to the changing nature of work will require investments in upskilling and lifelong learning to ensure individuals remain competitive in the digital era.
- 8 Write an application on *any one* of the following: 10
- a. Write an application to the concerned authority of your university for setting up a common room for students.
- Or,
- b. Write a letter to your closest friend sharing your experience of the first semester at Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj so far.
- 9 Write *any one* of the following: 10
- a. Suppose, you are Shahzada/Shahzadi. A foreign company has published an advertisement in *Prothom Alo* about a job opening for the position of 'Assistant Project Manager' on a contractual basis. You are eligible for the job. Now, write a resume along with a cover letter.
 - b. Suppose you are Anis/Anisa. You are interested in teaching jobs. Prepare a detailed CV so that you can apply for such positions.

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj

1st Year 1st Semester B.Sc (Engg.) Final Examination-2022

Department of Computer Science and Engineering

MAT 1107 : Calculus (3 Credits)

Time: 3 Hours

Full Marks: 70

Figures shown in the right margin indicate full marks.

Answer 05 out of 07 questions.

1. (a) What is function and its inverse function? Sketch the following functions (any two): [6]
(i) $f(x) = e^x - 1$ (ii) $f(x) = |x^2 - 4|$ (iii) $f(x) = 2\sin(x/2)$.
(b) The function $f(x)$ is defined as follows. [6]

x	-3	-2	-1	0	1	2	3
$f(x)$	-26	-7	0	1	2	9	28

Evaluate $y_1 = f(x) - 2$, $y_2 = -f(x)$, $y_3 = f(-x)$, $y_4 = f^{-1}(x)$,
and $y_5 = f(|x|)$.

- (c) Show that $f(x) = x^2 - 4x + 5$ is $\Omega(x^2)$. Also, indicate the value of c and k . [2]
2. (a) Define continuity of a function $f(x)$ at a point $x = a$. Discuss some type of discontinuity. [4]
(b) When does $\lim_{x \rightarrow a} f(x)$ exist? Use $(\epsilon - \delta)$ definition to show that $\lim_{x \rightarrow 3} x^2 = 9$. [4]
(c) State Intermediate Value Theorem (IVT). Verify this theorem for the function $f(x) = \cos x - x^2$ on the interval $[0, \pi]$. [6]
3. (a) "All continuous functions are not differentiable but all differentiable functions are continuous". Justify this statement at $x = 3$ and $x = 4$ of the function [5]

$$f(x) = |x + 2| + |x - 3| + 1.$$

- (b) Find $\frac{dy}{dx}$ of the following functions (any two): (i) $y = \cot \ln \cos(e^{x^2})$ [5]
(ii) $y = \sin(x^{\ln x})$ (iii) $x^2 y^2 = (y + 1)^2(4 - y^2)$.
(c) Find local linear approximation of $f(x) = 5\sqrt{1-x}$ at $x = 0$ and use it to approximate the value of $5\sqrt{0.9}$ and $5\sqrt{0.99}$. [4]
4. (a) The half-life of radium-226 is 1590 years. A sample of radium-226 has mass 100 mg. [5]
(i) Derive a formula for the mass of the sample that remains after t years.
(ii) Find the mass remaining after 1000 years correct to the nearest milligram.
(iii) When will the mass be reduced to 30 mg?
(b) Use L Hospital's rule to evaluate any two of the following: [4]

$$(i) \lim_{x \rightarrow 0} \frac{\tan x - x}{x^3} \quad (ii) \lim_{x \rightarrow \frac{\pi}{4}} \frac{\sin x - \cos x}{\tan x - 1} \quad (iii) \lim_{x \rightarrow 1} \left(\frac{1}{\log x} - \frac{1}{x-1} \right)$$

(c) If $f(x) = x^3 - 3x^2 + 1$ then

(i) find critical and inflection points of $f(x)$.

(ii) find the set of values of x for which the function $f(x)$ is increasing and decreasing, concave up and concave down.

(iii) sketch the graph of $f(x)$.

[7]

5. (a) Evaluate any two of the following indefinite integrals

$$(i) \int \frac{1}{x^2 \sqrt{4-x^2}} dx \quad (ii) \int \frac{1}{x^2 - 3x + 2} dx \quad (iii) \int \cos^5 x \sin^4 x dx$$

[7]

(b) Evaluate any two of the following definite integrals:

$$(i) \int_0^{\pi/2} \ln(\cos x) dx \quad (ii) \int_1^e x^2 \ln(x) dx \quad (iii) \int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx$$

6. (a) Define the anti-derivative of a function. Use the anti-derivative method to find the area under the curve $y = x^3$ over the interval $[0, 3]$

[4]

(b) Define Riemann sum. Defining definite integral as a limit sum and hence evaluate

[5]

$$\int_1^2 (4 - x^2) dx$$

(c) State Mean Value theorem (MVT) for Integrals. Verify MVT for the integral

[5]

$$\int_0^4 (8 - 2x) dx$$

7. (a) If f is a continuous function on $[a, b]$ and F is any anti-derivative of f on $[a, b]$, then prove that $\int_a^b f(x) dx = F(b) - F(a)$.

[5]

(b) Find the area of the region enclosed by $x = 2 - y^2$ and $y = -x$.

[4]

(c) Use cylindrical shells to find the volume of the solid generated when the region R in the first quadrant enclosed between $y = x$ and $y = x^2$ is revolved about the y -axis.

[5]

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
1st Year 1st Semester B.Sc. (Engg.) Final Examination-2022
Department of Computer Science and Engineering
PHY 1105: Physics (3 Credits)

Time: 3 Hours

Full Marks: 70

Figures shown in the right margin indicate full marks.
Answer 5 out of 7 questions.

1

- a. Define the specific heat and latent heat of a system. Explain graphically the relation between heat and work for different processes. 2+3
- b. An ideal gas is initially at the volume V_i , Pressure P_i , and temperature T_i . The gas is expanded isothermally to a new volume V_f , Pressure P_f . Calculate the amount of work done for this process. 4
- c. What mass of steam initially at 130°C is needed to warm 200-g of water in a 100-g glass container from 20.0°C to 50.0°C ? (Given, the specific heat of steam $2.01 \times 10^3 \text{ J/Kg} \cdot ^\circ\text{C}$, the latent heat of vaporization $2.26 \times 10^6 \text{ J/Kg}$, the specific heat of water is $4.19 \times 10^3 \text{ J/Kg} \cdot ^\circ\text{C}$, and the specific heat of glass is $837 \text{ J/Kg} \cdot ^\circ\text{C}$) 5

2

- a. Define entropy. Write down the statement of second law of thermodynamics. 4
- b. Define entropy of a system. Show that the entropy of the system increases for irreversible processes and remains constant for reversible processes. It never decreases. 5
- c. What is Carnot cycle? Describe four steps appeared in one cycle of Carnot engine and hence show that efficiency of the engine, η can be written as $\eta = 1 - T_L/T_H$, where symbols have their usual meanings. 5

3

- a. Define crystalline solid, amorphous solid, and unit cell of a crystal. 3
- b. Describe the Hexagonal, Orthorhombic, Monoclinic, and Triclinic crystal structures with examples. 4
- c. What is Bravais lattice? Describe 14 Bravais lattice by mentioning their figures, crystal system, symmetries, and properties of the unit cell. 7

4

- a. Define packing fraction. Calculate the packing fraction of the BCC and HCP lattice. 1+4
- b. What is dislocation? Explain edge dislocation and screw dislocation in details. 1+4
- c. What is a band? Explain the difference between metal, insulator, and semiconductor in terms of band diagram. 1+3

5

- a. Derive the differential equation of an object executing simple harmonic motion. Show that $x(t) = A\sin(\omega t + \phi)$ is a solution of the above equation. 3+3
- b. Show that the energy of a simple harmonic oscillator is constant. 4
- c. For a damped oscillator with mass $m=250$ g, $k=85$ N/m, and $b=70$ g/s. 4
 - I. What is the period of the motion?
 - II. How long does it take for the amplitude of the damped oscillations to drop to half its initial value?
 - III. How long does it take for the mechanical energy to drop to one-half its initial value?

6

- a. Two perpendicular simple harmonic motions superimpose in a place. Derive the general equation to form Lissajous figure in this case. 4
- b. Explain what happens if the phase difference between the waves are $\phi = \frac{\pi}{4}$ and $\phi = \frac{\pi}{2}$. 4
- c. Derive the differential equation of a plane progressive wave. 6

7

- a. Write down necessary conditions for interference of light. 3
- b. In a double slit interference experiment, the distance between the slits is 0.5 mm and the screen is 2 meters from the slits. Yellow light from a sodium lamp of wavelength 589 nm has been used. Calculate the distance between the first and second fringes on the screen. 4
- c. Describe the mathematical formulation to find out the wavelength of a monochromatic light by Newton's ring experiment. 7

Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
1st Year 1st Semester B.Sc. (Engg.) Final Examination-2022
Department of Computer Science and Engineering
CSE 1103: Discrete Mathematics (3 Credits)

Time: 3 Hours

Full Marks: 70

Figures shown in the right margin indicate full marks.
Answer 5 out of 7 questions.

1

- a. Demonstrate that the conclusion "We will be home by sunset" can be obtained by applying rules of inference on the following hypotheses: 4

"It is not sunny this afternoon and it is colder than yesterday", "We will go swimming only if it is sunny", "If we do not go swimming, then we will take a canoe trip", and "If we take a canoe trip, then we will be home by sunset".

- b. Find a counterexample of the statement: $\forall_n P(n)$ where 10
- $P(n)$: C_n is a Bipartite graph.
 - Domain of n is the set of all positive integers greater than 5.

Use appropriate algorithms and necessary illustrations to justify the answer.

2

- a. There are 5 boys and 7 girls in a group. Determine in how many ways 3 representatives can be chosen if there is at least 1 girl among them. 3
- b. Determine whether $((p \rightarrow q) \rightarrow (r \rightarrow s))$ and $((p \rightarrow r) \rightarrow (q \rightarrow s))$ are logically equivalent or not. 5
- c. Let $f: R \rightarrow R$ be defined by $f(x) = 2x^2 - 1$. 6
- i. Find domain, target (or codomain), and range of f .
 - ii. Is f one-to-one? Justify your answer.
 - iii. Is f onto? Justify your answer.

3

Consider the following procedure.

```
procedure bubblesort( $a_1, \dots, a_n$  : integer numbers with  $n \geq 2$ )  
for  $i := 1$  to  $n - 1$   
  for  $j := 1$  to  $n - i$   
    if  $a_j > a_{j+1}$  then interchange  $a_j$  and  $a_{j+1}$   
 $\{a_1, \dots, a_n$  is in increasing order}
```

Now a sequence of integers is given:

5 2 1 8 7 3 8

- a. Demonstrate a scenario in which the specified procedure will require the maximum number of interchange operations to sort a sequence of n integers in ascending order. Additionally, calculate the exact number of interchange operations needed in terms of n . 4

- b. Using the specified procedure, sort the given sequence in ascending order. Provide a step-by-step illustration of each stage involved in the sorting process. Additionally, determine the total count of necessary interchange operations performed during the sorting procedure of the given sequence. 10
- 4
- a. List down the rules of forming the Pascal's Triangle with suitable examples. 4
- b. Explain the Principle of Inclusion and Exclusion with the help of a Venn Diagram and then using the principle find the number of bit strings of length eight that start with two bits "10" and end with three bits "111". 4
- c. State the generalized Pigeonhole Principle and then using the Pigeonhole Principle prove that among any $n + 1$ positive integers not exceeding $2n$ there must be an integer that divides one of the other integers. 6
- 5
- a. Prove that, $p^2 - q^2 + \sum_{j=p}^q (p + q - 1) = 2p - 1$ 4
- b. Conjecture a formula for the sum of a finite number of terms of a geometric progression with initial term a and common ratio r . Then prove your conjecture using Mathematical Induction. 4
- c. Bangabandhu Sheikh Mujibur Rahman University (BSMRU), Kishoreganj, is preparing to launch its official website, which will include a student-login portal. Each student will be able to access their portal using a username and a password. In this system, an email ID is divided into two parts: the username and the domain. The username and domain are separated by the "@" symbol. 6
- The domain for all email IDs in this system follows a specific format. It starts with the departmental code and ends with ".bsmru.ac.bd". The departmental codes for the university's four departments are {"cse", "eng", "math", and "acc"}. For instance, in the email ID "xyz123@cse.bsmru.ac.bd", the username is "xyz123" and the domain is "cse.bsmru.ac.bd".
- Now, consider the restrictions on forming the username. A username can consist of alphanumeric characters and can be between six to eight characters long. It is important to note that the system does not distinguish between uppercase and lowercase letters. Additionally, each username must contain at least one digit, and starts with a letter.
- Now determine the total number of email IDs that can be generated in this system, given the restrictions mentioned above.
- 6
- a. Prove that a full binary tree with complete levels and a height of h contains a total of $2^{h+1} - 1$ number of nodes. 4
- b. Consider the following sequence of keys that has been generated by the postorder traversal of a Binary Search Tree. 10
- 15 25 20 35 45 40 30 55 65 60 75 85 80 70 50
- If the height of the tree is three then illustrate the figure of the tree.
- 7
- a. Contrast between adjacency matrix and incidence matrix to represent an undirected graph, using an example. Then, describe how the Handshaking Theorem can be applied to determine the number of edges in a graph based on its adjacency matrix representation. 4

- b. Consider a two dimensional coordinate system where i^{th} point is represented as $P_i(x_i, y_i)$. Distance between any two arbitrary points P_i and P_j is measured as: 7
- $$|x_i - x_j| + |y_i - y_j|$$

Now a list of four points are given in Table-7(b).

Table-7(b)

i	Point	x_i	y_i
1	P_1	2	-10
2	P_2	4	0
3	P_3	2	6
4	P_4	0	0

Illustrate weighted K_4 from the Table-7(b) considering the points are labeled as vertices and weight of an edge is measured by the distance of two of its end vertices.

After that, construct a minimum spanning tree of the illustrated graph using an appropriate algorithm showing all the necessary steps and finally mention the cost of the tree as well.

- c. Given that the graph K_n has 21 edges. 3
- Find the number of vertices that K_n is composed of.
 - Determine the degree of each vertex.
 - Calculate the sum of the degrees of all its vertices.

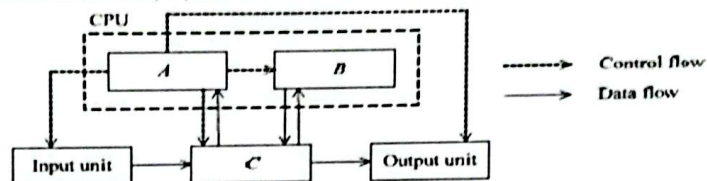
Bangabandhu Sheikh Mujibur Rahman University, Kishoreganj
1st Year 1st Semester B. Sc. (Engg.) Final Examination-2022
Department of Computer Science and Engineering
CSE 1101: Computer Fundamentals (3 Credits)

Time: 3 Hours

Full Marks: 70

Figures shown in the right margin indicate full marks.
 Answer 5 out of 7 questions.

- 1 a. The basic configuration of a computer, which includes five major units (or sometimes called five major functions), is shown in the figure below. Write down the appropriate combination of configuration elements to be inserted in blanks A through C. Describe the functionalities of A, B, and C in a brief. 7



- b. Define system and its characteristics. Discuss why computer is known as a system. 3
 c. State why computer is called data processor. Describe the basic operations of a computer system in a detail. 4
- 2 a. Perform the following operations (show all the necessary steps): 3
 i. Convert $(6752)_8$ to $(?)_2$
 ii. Convert $(10101101110)_2$ to $(?)_{16}$
 iii. Convert $(7BBE)_{16}$ to $(?)_8$
 b. Find the subtraction of $(22C)_{16}$ and $(6D)_{16}$. Perform left logical shift operations and right arithmetic shift operations on the binary number 1001101111 by three bits. 3
 c. Perform the following operations (show all the necessary steps): 4
 i. Subtract $(100101)_2$ from $(111101)_2$ using complementary method
 ii. Divide $(11110110)_2$ by $(101)_2$
 d. Write binary coding for the word BSMRU in ASCII-8. Calculate the number of bytes required for this representation. 4
- 3 a. Distinguish between flowchart and algorithm. 3
 b. Illustrate flowchart to accomplish the following task. 3+4
 i. To find the maximum among three numbers where all the three numbers are taken as input from user
 ii. To find the root of the quadratic equation $ax^2 + bx + c = 0$ where the coefficients a , b , and c are taken as input from the user.
 c. Contrast between syntax error and runtime error in a program. 4
- 4 a. Write down the main difference between *break* and *continue* statements in C. Rewrite the following if...else statement using ternary operator. 3

```
if (5 > 3) {
    result = 9;
}
else {
    result = 3;
}
```

- b. Find the output of the following program and state the reasons of such output. 3

```
#include<stdio.h>
#define x 4+2
int main()
{
    int i= x*x*x;
    printf("%d\n", i);
    return 0;
}
```

- c. Identify the output of the following program and explain the reasons of such output. 4

```
#include <stdio.h>
int main()
{
    int a, b;
    b = 10;
    a = ++b + ++b;
    printf("%d %d", a, b);
    return 0;
}
```

- d. List out the general rules for naming variables in C language. Label and explain why following variable name are legal or illegal. 4

6june, _2022abc, return, saving#account, %correct, first name.

- 5 a. Write a program in C language that takes a character as user input and displays the given character is vowel or consonant. 4

Sample Input	Sample Output
Input a character: g	The given character g is a consonant.

- b. Write a program in C language that takes numbers as user input to find the largest number among the three numbers. 5

Sample Input	Sample Output
Input three numbers: 10.50 27.50 25.70	27.50 is the largest number among three.

- c. Write a program in C language that takes numbers as user input to display the multiplication table for the given integer. 5

Sample Input	Sample Output
Input the number (Table to be calculated): 15	15 X 1 = 15 ... 15 X 10 = 150

- 6 a. Identify the output of the following program and explain the reasons of such output. 4

```
#include<stdio.h>
int main()
{
    int a=1;
    do
    {
        if (a==3) break;
        printf("%d ", a);
        a++;
    }while(a <= 10);
    return 0;
}
```

- b. Write a program in C language that takes a single integer as user input and displays the number in reverse order. 5

Sample Input	Sample Output
Input a number: 12345	The number in reverse order is 54321.

- c. Write a program in C language that takes integer as user input and displays a pattern like a right-angle triangle using an asterisk. 5

Sample Input	Sample Output
Input the number: 3	* ** ***

- 7 a. Write short note on the following (any *four* out of *six*) 8

- i. DNS server
- ii. Ping and Traceroute
- iii. OSI model
- iv. Device driver and utility software
- v. Operating System
- vi. Phases of a typical programming task

- b. Write down the difference between (any *three* out of *five*) 6

- i. Program and Pseudocode
- ii. RAM and ROM
- iii. Application software and System software
- iv. MAC address and IP address
- v. SRAM and DRAM