Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science & Engineering

Final Examination, 2023 — **3rd Year 1st Semester**
Course No: CSE 505 — **Course Title: Microprocessors and microcontroller**
Time: 03 (Three) hours — **Full Marks: 60**

N.B. : (i) Answer any three questions from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A--------

PART-A
(Answer any three questions)

1. (a) What do you mean by logical address? 01
   (b) For the memory location whose physical address is specified by 1256Ah, give the address in segment: offset form for segments 1256h and 1240h. 03
   (c) Explain the calculation of the physical address for the instruction MOV AX, [BX] when BX = 1A0Ch and DS = 0230h 02
   (d) What are the meanings of the following instructions and which addressing mode is used them: 04
   i) MOV AX, [BP+SI] ii) MOV DX, CX iii) MOV AL, [BX+DI+04h]

2. (a) Write assembly code for the following decision structure. 03

```
IF AL < 0
THEN
put FFh in AH
ELSE
put 0 in AH
END_IF
```

   (b) Write down the pin functions for the minimum mode operation of 8086. 03
   (c) Write down the pin description of **S0', S1' & S2', MN/MX', RQ'/GT0' & RQ'/GT1, and LOCK'.** 04

3. (a) What is Flag Register? 02
   (b) Briefly explain what happens when the INTR signal goes high in the 8086 microprocessor. Include the role of the Interrupt Flag (IF) in the process. 03
   (c) Explain the function of the FLAG register in the 8086 microprocessor. Describe the roles of both status and control flags, highlighting the significance of each flag. 05

4. (a) What is Controller? 02
   (b) List and briefly explain the basic characteristics of a microprocessor. 03
   (c) Explain the addressing modes of 8086 microprocessor with example. Include at least five key addressing modes in your explanation. 05

PART-B
(Answer any three questions)

5. (a) What is High-Level Language? 02
   (b) Discuss the backward compatibility of the x86 family of microprocessors. 04
   (c) Determine the addressing mode of the following instructions and explain the reasoning behind the answer: 04

   I. MOV DX, [SI + 8]
   II. ADD BX, [BP]
   III. SUB AX, [3000H]

6. (a) Explain the three major components of an embedded system, and briefly describe the role of each in the functioning of the system. 03

(b) Given the following segment and offset values: 07

A. Data Segment (DS) = 3000H
B. Stack Segment (SS) = 7000H
C. Extra Segment (ES) = 4000H
D. BP = 0500H
E. SI = 0040H
F. DI = 0200H
G. BX = 0900H
H. Displacement = 0800H

Calculate the Physical Address (PA) for the instruction MOV AX, [DS: BX + SI + 0800H] and explain how it is computed.

7. (a) Define Assembly Language and Paragraph boundary. 02

(b) Determine whether the following numeric representations are legal. For each valid number, specify whether it is binary, decimal, octal, or hexadecimal. Explain the rationale for each classification. 05

1. 11011
2. 0x1A3
3. 075
4. 3F7
5. 2B.4
6. 1010.01B
7. 12D
8. -0x3C
9. 245.8
10. 1.2.3

For any invalid representations, explain why they are illegal.

(c) Describe the basic structure of an assembly language program. Include key sections and their purposes. 03

8. (a) How many address pins are needed to address a 4MB memory location? Show your calculations. 02

(b) Draw a simple NAND gate decoder used to select a 2716 EPROM memory component and briefly describe the operation. 04

(c) If CS=24F6H and IP=634AH, determine: 04

i) The logical address
ii) The offset address
iii) The physical address
iv) The lower range of the code segment

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Final Examination, 2023 — **3nd Year 1st Semester**
Course No: CSE 511 — **Course Title: Communication - I**
Time: 03 (Three) hours — **Full Marks: 60**

N.B. : (i) Answer any three question from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any three questions)

1. (a) Find the minimum Hamming Distance of the words: 10101, 11110, 01011 — 01
   (b) Consider the five numbers: 3, 6, 2, 15, 4
   Apply Checksum technique and show how it works at the sender site and receiver site. — 04
   (c) You are given the dataword 10100111 and the divisor 10111. Calculate the codeword using CRC method. Show how the dataword is accepted and discarded at the receiver site. — 05

2. (a) A periodic composite signal with a bandwidth of 2KHz is composed of two sine waves. The first one has a frequency of 100Hz with maximum amplitude of 20V; the second one has maximum amplitude of 5V. Draw the bandwidth. — 05
   (b) Suppose a telephone line has a bandwidth of 4 kHz. If the signal is 20 V and the noise the 12 mV then what is the maximum data rate supported by the telephone line? — 03
   (c) Explain the components of a communication system with a block diagram. — 02

3. (a) An analog signal has a bit rate of 8000 bps and a baud rate of 1000 baud. How many data elements are carried by each signal element? How many different signal elements are needed? — 02
   (b) What is carrier frequency? Explain PSK with an appropriate figure. — 04
   (c) If you want to send data 3 bits at a time with a bit rate of 3 Mbps and the carrier frequency of 10 MHz. Calculate the number of levels (different frequencies), the baud rate, and the bandwidth. — 04

4. (a) Differentiate between synchronous and asynchronous data transmission. — 02
   (b) Draw the graph of data 10100101 streams for the Unipolar, NRZ-L, NRZ-I and Manchester encoding. — 04
   (c) Draw the digital signal of the sequence 1110000000000 using the HDB3 scheme, assuming that the last non-zero signal level is positive and the number of nonzero pulses is odd after the last substitution. — 04

PART-B
(Answer any three questions)

5. (a) Four 1-kbps connections are multiplexed together. A unit is 1 bit. Find — 04
   i) the duration of 1 bit before multiplexing ii) The transmission rate of the link
   iii) the duration of time slot and iv) the duration of a frame.
   (b) How traditional circuits switch network transfer data from one port to another port? — 03
   (c) Describe star and bus topology with figure. — 03

6. (a) Differentiate between port address, logical address and physical address. — 02
   (b) i) Define Protocol and Internet. — 04
   ii) Assume you're playing an online game. Which protocol will be used in this situation, and why?
   (c) Contrast the OSI model with the TCP/IP model. Using a diagram, show the correspondence between relevant protocol layers in the two models. Why is TCP/IP used rather than OSI? — 04

7. (a) Provide appropriate examples of Multilevel Multiplexing, Multiple Slot Allocation and Pulse Stuffing. 03

(b) Differentiate between unicast, multicast, and broadcast addresses. 03

(c) Explain how Flow control and Error control are important in a data link layer protocol. What are two ways to handle a situation where the receiving end can't process frames quickly enough? 04

8. (a) What is Transmission Media? Different Between Guided and Unguided transmission media. 03

(b) How does Optical Fiber work? Mention two advantages of Optical Fiber. 03

(c) Compare and contrast virtual-circuit networks and datagram networks in terms of addressing, data transfer, and connection phases. 04

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Final Examination, 2023 | **3rd Year 1st Semester**
Course No: CSE 507 | **Course Title: Operating System**
Time: 03 (Three) hours | **Full Marks: 60**

N.B. : (i) Answer any three question from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

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PART-A
(Answer any three questions)

1. (a) Briefly explain the differences between Multiprogramming, Time-sharing, and Multitasking. How does each approach improve CPU utilization? 04

   (b) How do device drivers and interrupts facilitate communication between the operating system and hardware? 02

   (c) What is a semaphore? What are the disadvantages of using semaphores and what construct is used to counter them? 04

2. (a) What is the primary benefit of symmetric multiprocessing? How does it differ from asymmetric multiprocessing? 02

   (b) Draw a process control block and briefly describe how each element is used by the operating system. 04

   (c) What is a context switch? Why is it important for process management? 04

3. (a) Explain the role of a ready queue and a wait queue in process scheduling, and describe how processes move between them. 04

   (b) What are the main functions of a dispatcher in process scheduling? Why is its speed important? 04

   (c) How do non-preemptive and preemptive algorithms vary from one another? 02

4. (a) What is Deadlock? Write and explain the necessary conditions for Deadlock. 1+2

   (b) Consider the following snapshot of a system and answer the following questions using Banker's Algorithm. 07

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_1	0	0	1	2	0	0	1	2	1	5	2	0
P_2	1	0	0	0	1	7	5	0				
P_3	1	3	5	4	2	3	5	6				
P_4	0	6	3	2	0	6	5	2				
P_5	0	0	1	4	0	6	5	6				

   i) Is the system safe? If yes find the safe sequence.
   ii) If a request from process P arrives for (0,4,2,0) can request be granted immediately?

PART-B
(Answer any three questions)

5. (a) What factors determine whether a process is CPU-bound or I/O-bound, and how does this affect scheduling decisions? 03

(b) Given the following set of processes, construct Gantt charts for First-Come, First-Served (FCFS) and Priority scheduling, then determine the average waiting, response, and turnaround times: 07

Process	Arrival Time	Burst Time	Priority
P_1	0	4	2
P_2	1	3	1
P_3	2	7	4
P_4	4	1	3
P_5	3	5	5

6. (a) What is virtual memory? How we can implement virtual memory concept? 1+2

(b) Under what circumstances do page faults occur? Describe the actions taken by the OS when a page fault occurs. 02

(c) Consider the given page reference string: 1, 2, 3, 4, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the following replacement algorithms assuming 5 frames? 05

i) LRU ii) FIFO iii) Optimal

7. (a) Draw the resource allocation graph for the following processes. 04

$P=\{p_1, p_2, p_3, p_4\}$, $R=\{r_1, r_2, r_3\}$, $E=\{p_1 \rightarrow r_1, r_1 \rightarrow p_2, p_2 \rightarrow r_2, r_2 \rightarrow p_3, p_3 \rightarrow r_3, r_3 \rightarrow p_1\}$

Is there any Deadlock in above graph?

(b) What are the main differences between the concepts of a resource allocation graph and a wait-for graph? 03

(c) Explain how virtual memory is implemented with paging, and discuss its advantages for memory management. 03

8. (a) Explain what internal and external fragmentation are, and discuss how paging and segmentation address these issues. 04

(b) What is the purpose of the medium-term scheduler, and how does it relate to the concept of swapping? 03

(c) Describe compaction and explain when it would be most useful in a memory management context. 03

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Final Examination, 2023 — **3rd year 1st semester**
Course No: CSE 503 — **Course Title: Computer Graphics**
Time: 03 (Three) hours — **Full Marks: 60**

N.B. : (i) Answer any three question from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A--------

PART-A
(Answer any three questions)

1) a) Define Aspect ratio of view port. 01

b) If we want to resize a 1024 X 768 image to one that is 640 pixels wide with the same aspect ratio, what would be the height of the resized image? 02

c) What is resolution of an image? If we want to cut a 512 X 512 sub-image out from the center of an 800 X 600 image, what are the coordinates of the pixel in the large image that is at the lower left corner of the small image? 1+2

d) Design a color coordinate system using three primary complementary colors and construct a formula that summarizes the conversion between RGB and CMY color models. 04

2) a) What do you mean by Scan-Conversion? 01

b) What steps are required to plot a line whose slope is between 0° and 45° using slope-intercept equation? 03

c) Translate a Square ABCD with the coordinates A(1,1), B(5,1), C(5,5) and D(1,5) by 3 units in X-direction and 2 units in Y-direction. 02

d) Given a window and view port, what is the transformation matrix that maps the window world coordinate into the view port in the screen coordinate? 04

3) a) Explain briefly the eight-way symmetry of a circle. 01

b) Given the center point coordinates (0, 0) and radius as 10, generate all the points to form a circle using Bresenham's Circle drawing algorithm. 05

c) Indicate which raster locations would be chosen by Bresnsham's algorithm when scan-converting a line from pixel coordinate (2, 2) to pixel coordinate (9, 5). 04

4) a) Write down the basic transformation matrices of geometric translation, scaling and mirroring. 02

b) Let an axis of rotation L be specified by a direction vector V and a location point P. Find transformation for a rotation of θ_0 about L. Draw suitable figures. 04

c) Find a transformation of triangle A(1,0),B(0,1),C(1,1) by 04
i. Rotating 45^0 about the origin and then translating one unit in x and y direction.
ii. Translating one unit in x and y direction and then rotating 45^0 about the origin.

PART-B
(Answer any three questions)

5) a) What is clipping? Write the name of different types of Clipping. 1+1

b) Using Cohen Sutherland algorithm assign 4 bit region code to each endpoint of the lines shown in fig-1 02

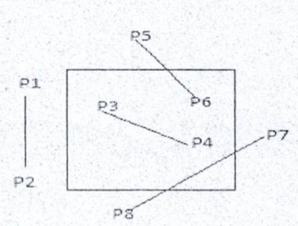
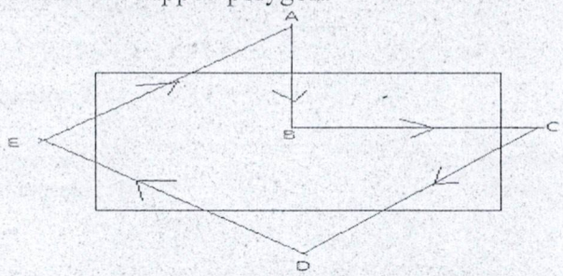


Fig-1

c) Consider a polygon with vertices ABCDE. Apply Sutherland-Hodgeman polygon clipping algorithm to find the clipped polygon. 06



6) a) Define curve and describe about types of curves. 1+1
b) Write the properties of B-Spline Curves. 02
c) Given a Bezier curve with 4 control points- $B_0[1\ 0]$, $B_1[3\ 3]$, $B_2[6\ 3]$, $B_3[8\ 1]$. Determine any 5 points lying on the curve. Also, draw a rough sketch of the curve. 06

7) a) Explain the differences between lossy and lossless compression with examples. How do these methods affect the quality and size of multimedia files like images, audio, and video? 2+2
b) Describe the Run-Length Encoding (RLE) technique and demonstrate how it compresses the string 'AAAABBBCCDAA'. 02
c) Explain the differences between the Phong illumination model and the Blinn-Phong illumination model in terms of how they handle specular highlights. Discuss the impact of these models on rendering performance and visual quality. 2+2

8) a) What is the concept of hidden surface? 01
b) What happens when two polygons have the same z value and Z-buffer algorithm is used? 02
c) Explain the underlying concept of the painter's algorithm? What are the problems in implementing the painter's algorithm? 2+2
d) What is projection? How may the properties of parallel projection be used to simplify hidden-surface calculations for any form of projection? 1+2

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Final Examination, 2023 — **3rd Year 1st Semester**
Course No: CSE 509 — **Course Title: Computer Architecture**
Time: 02 (Two) hours — **Full Marks: 40**

N.B. : (i) Answer any two question from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any two questions)

1. (a) Write the basic functional units of computer. 01

(b) Translate the HLL code below to MIPS assembly. Every instruction should have a comment![Complete the question with 10 instructions or less] 03

HLL Code:

if (i==j) {
a[i]=b[j];
}
else {
a[i]= b[j+1];
}
	Assume the following
	The starting address of array a[] is in $20
	The starting address of array b[] is in $21
	Index i maps to $5
	Index j maps to $6
	If any temporary registers are used, please start with $10

(c) State Amdahl's law. List out the methods used to improve system performance. 03

(d) Suppose that we want to enhance the processor used for Web serving. The new processor is 10 times faster on computation in the Web serving application than the original processor. Assuming that the original processor is busy with computation 40% of the time and is waiting for I/O 60% of the time, what is the overall speedup gained by incorporating the enhancement? 03

2. (a) Design a 4-bit ALU that will function as follows: 04

Select Lines		Function to be performed
S_1	S_0	
0	0	Addition
0	1	2's complement subtraction
1	0	Boolean AND
1	1	Exclusive-OR

(b) Consider the following equation $Y=\frac{A+B}{C*(D-E)}$ 04

Now, write the instructions with comments for: i) 3- Address instructions
ii) 2- Address instructions

(c) What is a tightly coupled and loosely coupled multiprocessor? 02

3. (a) State the Flynn's classification for parallel multiprocessing computers. 02

(b) What is Bus Arbitration? Explain Daisy chaining & pooling with figure. 03

(c) Our favorite program runs in 10 seconds on computer A, which has a 2 GHz clock. We are trying to help a computer designer build a computer, B, which will run this program in 6 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of the CPU design, causing computer B to require 1.2 times as many clock cycles as computer A for this program. What clock rate should we tell the designer to target? 05

PART-B

(Answer any two questions)

4 (a) What are bits, bytes, and other units of measure for digital information? 02

(b) Construct control word 8255A bit definitions to configure port-A and upper port-C as input ports and port-B and lower port-C as output ports in mode-0. 03

(c) Why Booth's algorithm used for? Multiply the (-3) with (-7) using booth's algorithm. Show the flowchart and give each step. 05

5. (a) Explain virtual memory and the advantages of using virtual memory 03

(b) What is meant by super scalar processor? In many computers the cache block size is in the range 32 to 128 bytes. What would be the main Advantages and disadvantages of making the size of the cache blocks larger or smaller? 03

(c) Compare Static RAM and Dynamic RAM. 02

(d) What are the techniques to improve cache performance? 02

6. (a) Suppose that you have a pipelined machine with 4 pipe stages where each sub operation in each pipe stage takes 20ns. If you perform 100 tasks in such a machine then what will be the speedup? 02

(b) Consider a 14 bit model for floating point representation with a 5 bit exponent and an 8 bit significant. Express -26.625 using this model. 04

(c) If we assume we place the loop starting at location 80000 in memory, what is the MIPS assembly code and machine code for following code? 04

```
for(inti=0;array[i]!='\0'; )
{
                    i+=1;
}
```

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Final Examination, 2023 — **3rd Year 1st Semester**

Course No: CSE 501 — **Course Title: Database Management System**

Time: 03 (Three) hours — **Full Marks: 60**

N.B. : (i) Answer any three questions from each PART (ii) Use separate answer scripts for each PART
(iii) Marks allotted are indicated in the margin (iv) Special Instruction (if any)-------N/A---------

PART-A
(Answer any three questions)

1. (a) What are super key, primary key and candidate key? What are the drawbacks of using file systems to store data? 1+2

   (b) Include the required diagram to explain the various DBMS levels of abstraction. 03

   (c) Write the properties of DDL and DML. Write Short notes of the following terms: 2+2
   Hierarchical Data Model, Object Based Logical Model

2. (a) Consider the following database schema - 4×2=8
   customer(customer_name, customer_street, customer_city)
   branch(branch_name, branch_city, assets)
   depositor(customer_name, account_number)
   account(account_number, branch_name, balance)
   borrower(customer_name, loan_number)
   loan(loan_number, branch_name, amount)
   Now, represent the following operations using Relational algebra expression:
   i. Find the maximum account balance of customers in each branch.
   ii. Find out all customers name with their account number who are living in 'Sylhet' city.
   iii. Find out all customer names who do not have a loan.
   iv. List the names and street of customers who live in 'Sylhet' city

   (b) List the several kinds of operators in relational algebra. 02

3. (a) Consider the following database schema: 4×2=8
   Employee *(person-name, street, city)*
   Works *(person-name, bank-name, salary)*
   Bank *(bank-name, city)*
   Manages *(person-name, Manager-name)*
   Write **SQL** expression for the following queries:
   a) Find the name of employee who gets the maximum salary.
   b) Find the names of all employees who do not work for Bangladesh bank.
   c) Find the names of all employee who live in Sylhet and work for Bangladesh bank
   d) Find the number of employees who earn more than the average salary

   (b) Discuss about Cross Join and Full Outer Join with example. 02

4. (a) What is Conflict Equivalent and Conflict Serializable? Write with example. 03

   (b) How you can measure the performance of a disk? Discuss different techniques to improve the speed of access of blocks. 05

   (c) Describe ACID properties. 02

PART-B
(Answer any three questions)

5. (a) Suppose you are given a relational schema R=(A,B,C,G,H,I) and the set of functional dependencies 05

   $A \rightarrow B$
   $A \rightarrow C$
   $CG \rightarrow H$
   $CG \rightarrow I$
   $B \rightarrow H$

   Now, logically imply the following functional dependencies $A \rightarrow H$, $AG \rightarrow I$, $CG \rightarrow HI$ using the above information.

(b) Draw the following **E-R** notations. 05

i) Identifying Relationship set
ii) Total participation
iii) Partial key
iv) one-to-many relationship

6. (a) Given below is the data on **Product Cost Report of Good News Grocers Shop** in an un-normalized table. Normalize it to 1F. Identify the problems encountered when the table is in 1NF but not in 2NF. Subsequently Normalize to 2NF, BCNF and 3NF, explaining the problems faced and the solution to it. 06

Supplier	**Product**	**Cost**	**Markup**	**Price**	**Dept Code**
21 – Very Veggie	4108 – tomatoes, plum	1.89	5%	1.99	PR
32 – Fab Fruits	4081 – bananas	0.20	75%	0.35	PR
32 – Fab Fruits	4027 – grapefruit	0.45	100%	0.90	PR
10 – Jerry's Juice	411100 – orange juice	0.25	400%	1.00	FR
10 – Jerry's Juice	521101 – apple juice	0.25	400%	1.00	FR
45 – Icey Creams	866503 – vanilla ice cream	2.50	100%	5.00	FR
45 – Icey Creams	866504 – chocolate ice cream	2.50	100%	5.00	FR

(b) What do transitive and full functional dependencies mean? Discuss about different types anomalies in Database. 1+3

7. (a) Describe how to link several secondary storage devices using RAID technology. 04

(b) Draw the B+ tree to index the following elements: 2,3,5,13, 17,19,23,29,31,37,41,43 and 47. Delete two elements 31 and 43 and redraw the tree. 05

(c) Sketch out the transaction's state diagram. 01

8. (a) What is Block chain Database? Compare between **Block chain and Database.** 1+3

(b) Distinguish between OLAP and OLTP. What Qualities Make Up a Data Warehouse? 1+2

(c) How does a block chain operate? 03