

	<b>University of Rajshahi</b>			
	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
	B.Sc. Engineering Part IV Odd Semester Exam-2022			
	Course Code: CSE4111 Course Title: Parallel Processing and Distributed System			
Time: 03 Hours				Full Marks: 52.50

**SECTION A**  
**ANSWER ANY THREE OF THE FOLLOWINGS**

- 1.(a) Why are we developing parallel systems instead of sequential systems? [3.00]  
(b) Why do we need to write parallel programs based on parallel algorithms? [3.25]  
(c) How can we exploit instruction level parallelism and loop level parallelism? [2.50]
- 2.(a) How Flynn classifies computers? Discuss with necessary diagrams. [3.00]  
(b) Differentiate between the characteristics of CISC and RISC processor architectures. [2.00]  
(c) Briefly explain the architecture, instruction format, and pipeline operations of a typical VLIW processor with necessary diagram. [3.75]
- 3.(a) Define speedup, efficiency and throughput. [2.25]  
(b) Define interleaved memory organization. Compare between high-order memory interleaving and low-order memory interleaving? [3.50]  
(c) Draw the interconnection structure of a generalized multiprocessor system. [3.00]
- 4.(a) Classify pipeline processors according to the levels of processing. [1.75]  
(b) Draw and explain the structure of a pipeline floating point adder. [3.50]  
(c) Explain the functional segmentation of typical storage-to-register floating point instruction in the IBM 360/91. [3.50]

**SECTION B**  
**ANSWER ANY THREE OF THE FOLLOWINGS**

- 5.(a) What is false sharing? Explain with an example. [2.75]  
(b) What are the differences among mutex, busy-waiting and semaphore? [3.00]  
(c) What is the purpose of using Allgather() function in MPI? [3.00]
- 6.(a) Distinguish between local and remote distribution. [1.50]  
(b) Write the main factors that trend to distributed processing. [3.00]  
(c) What are the basic differences between function and system distribution? [2.00]  
(d) Write different categories of data distribution. [2.25]
- 7.(a) Write the role of transaction manager and transaction coordinator for a distributed database. [2.75]  
(b) What is fragmentation? Differentiate between horizontal and vertical fragmentation with example. Also write their advantages. [3.50]  
(c) What are the main reasons of failure of a distributed transaction? [2.50]
- 8.(a) Briefly explain two-phase commit protocol. [4.00]  
(b) What is replication? Write some advantages and disadvantages of data replication. [2.25]  
(c) Define Heterogeneous Distributed Databases. Write its advantages [2.50]





**University of Rajshahi**  
**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**B.Sc. Engineering Part IV Odd Semester Exam-2022**  
**Course Code: CSE4121 Course Title: Object Oriented Design and Design Patterns**

Full Marks: 35

Time: 02 Hours

**SECTION A**

**ANSWER ANY TWO OF THE FOLLOWINGS**

1. a) In terms of Object-oriented analysis and design—explain the situations in which a software project may fail. 3  
b) During the process of software design, what are the “Trade-offs between the client's need and Developer's Scope—explain with an example. 4  
c) What Conceptual Mock-ups illustrate in the Software design process? 1.75
2. a) Consider a parent class, and a child class—where child classes inherit attributes and behaviours of parent classes—explain what type of design principle is appropriate here. 3  
b) The computation steps taken within a class never need to be known by any other class, as long as they are able to access the interface. What type of encapsulation occurs here? Explain with a potential example. 3  
c) Describe the steps of model checking in the software design concept. 2.75
3. a) What is coupling? Describe different couplings with examples. 2  
b) What is the concept of Separation of Concerns in object-oriented design, and how does it contribute to the development of robust and maintainable software systems? 3  
c) Imagine you are tasked with designing a UML sequence diagram for a simple online ordering system. Walk through the steps you would take to create the diagram, including identifying the objects, their interactions, and the order of messages exchanged to illustrate the order processing workflow. 3.75

**SECTION B**

**ANSWER ANY TWO OF THE FOLLOWINGS**

4. a) Demonstrate the proxy pattern principle with a UML diagram. 3.5  
b) Decorator design pattern allows additional behaviors or responsibilities to be dynamically attached to an object—explain this situation with a proper example. 3.5  
c) What are the major components of the composite pattern? 1.75
5. a) Consider an executive chef who oversees a large chain of restaurants that serves pasta. Draw a UML diagram to solve this problem in terms of ‘Template Method Pattern’. 4.25  
b) A vending machine has several states, and specific actions based on those states, such as purchasing a chocolate bar that costs one dollar. What type of design pattern can be used to design the vending machine software-- explain with a UML diagram. 4.5
6. a) You have been asked by a local coffee shop to create a system that allows managers to see, edit and add employee information. You have decided to create a web application. They have informed you that they may decide to grow and expand later on and would like the system to be flexible to expansion. In this case the MVC pattern should be used. 4  
Create a UML class diagram that displays the basic MVC pattern for this web application. The system should keep track of an employee's name, ID number, job title and salary. The controller should be able to get the employee model's properties (getter methods) and change the properties (setter methods). The view should only display employee info.  
b) Describe the Dependency Inversion principle? 2.75  
c) How can Comments be considered a code smell? 1  
d) Look at the code snippet. Which code smell do you detect? 1

```
public class Class1 {  
    ...  
    public void M(Class2 C) {  
        C.doSomething(x);  
        C.foo(y);  
        C.foo2(z, i);  
    }  
}
```



## Department of Computer Science and Engineering

B.Sc. Engg. Part-4 (Odd Semester) Examination 2022

Course: CSE4131 (Computer Simulation and Modeling)

Full mark: 52.5; Time 3 hours

Answer six questions taking any three from each section

## SECTION A

- 1.(a) Document the steps of the simulation study along with an appropriate flowchart. [4%]  
 (b) What are the differences between discrete system simulation and continuous system simulation? Discuss some applications of continuous system simulation. [4]
- 2.(a) What are the three key parameters in the linear congruential method (LCM), and how do they influence the quality of random numbers generated? [2%]  
 (b) What is the concept of a "seed" in the LCM, and why it is essential? [2]  
 (c) What is meant by Pseudo Random numbers? Why are they called Pseudo? [2]  
 (d) Why do Random Numbers need to be tested? "There should be no favored number"- which test for Random Numbers ensures this property? [2]
- 3.(a) Why should we perform different types of tests on Pseudo-random numbers? Name some of such tests. [2]  
 (b) What is the Run test, and what is the primary purpose of statistical analysis? [2]  
 (c) In a manufacturing process, you are measuring the diameter of bolts produced. You want to check if the variation in bolt diameter is random or if there are systematic deviations. You collect data on the diameter of 50 bolts and record whether they are within specification or not. Here's a simplified dataset with "W" for within specification and "O" for out of specification:  
W, W, W, O, O, W, O, W, W, W, W, W, O, O, W, W, O, W, W, W, W, W, O, W, W, W, O, O, W, O, W, W, W, W, W, W, O, O, W, W, W, W, W, W, O, O, W, W, W, O, O, O, W, W, W, W, O, W, O, W  
 Perform a run test to check if there's a pattern or non-random variation in the data.  
 (Given that at a 5% level of significance, the critical value is 1.96 for two-tail)
- 4.(a) What is the Critical Path Method (CPM) in the context of project management? Explain the concept of activities and events in the context of CPM. [4]  
 (b) Draw the network diagram and identify the critical path using the following activity table. [4%]

Activity	Duration	Predecessors
A	3 days	-
B	5 days	A
C	4 days	A
D	6 days	B, C
E	2 days	C
F	5 days	D

## SECTION B

- 5.(a) Compared between physical and mathematical models in brief. [3]  
 (b) Explain the concept of a Corporate model. [3%]  
 (c) How do you calculate the area of a polygon by using geometric tables? [2]
- 6.(a) What is a cardinal spline? How does it differ from other types of splines like Bezier or B-splines? [2]  
 (b) How are cardinal splines defined mathematically? In cardinal splines, what is the role of the tension parameter, and how does it affect the curve's behavior? [4%]  
 (c) What are the key properties of a cardinal spline that make it suitable for curve modeling? [2]
- 7.(a) Discuss the additional parameters introduced by Kochanek-Bartels splines to provide further flexibility in adjusting the shape of curve sections. [4%]  
 (b) Note the distinct features of a b-spline curve when compared to a Bezier curve. [3]  
 (c) What are the limitations of the Bezier curve? [1%]
- 8.(a) What is a fractal object? Can you classify fractal objects? How? [3]  
 (b) The wireframe model has some specific advantages. -What are they? [2%]  
 (c) What do you know about the constructive solid-geometry method of modeling? Explain with an example. [3]

**University of Rajshahi**  
**Department of Computer Science and Engineering**  
**B.Sc. Engg. Part-4 Odd Semester Examination-2022**  
**Course: CSE4141 (Computer Peripherals and Interfacing)**

**Full Marks: 52.5**

**Duration: 3 Hours**

**[N.B. Answer any SIX questions taking THREE from each of the section]**

**Section- A**

1. a) What is meant by computer peripheral interfacing? Explain with example. 2.75  
b) Distinguish between port-addressed I/O and memory-mapped I/O. 3  
c) Draw the timing-waveform of the execution of instruction IN 84H. 3
2. a) Is it possible in interfacing, IN 20H and then OUT 20H? Explain why or why not. 2  
b) Explain absolute address decoding and partial address decoding with example. 3  
c) Discuss how a processor is interfaced with a common anode seven-segment LED using a decoder and a latch as an output port. Also write the program to display digit 5 to the output port. 3.75
3. a) Explain why handshake signals are used to interface I/O devices with processor. 2  
b) Discuss how maximum time delay is calculated in 8085 using a register pair with a nested loop. 3  
c) Discuss an interfacing circuit to design a safety control system for home appliances using a decoder, a buffer as an input port and a latch as an output port. Also write the program to operate the controlling system. 3.75
4. a) How long can the INTR pulse stay high? 2  
b) Discuss the 8085 vectored interrupts with necessary diagram. 4.75  
c) Explain the use of SIM and RIM instructions. 2

**Section- B**

5. a) Discuss how an 8-bit A/D converter is interfaced with processor using status check I/O technique. 4  
b) Design an output port with the address FFH to interface the 1408 D/A converter that is calibrated for 0 to 10V range. Write a program to generate a continuous ramp waveform. Explain the operation of the 1408 for the calibration of a bipolar range +5V to -5V. Calculate the output  $V_o$  if the input is  $10000000_2$ . 4.75
6. a) What is meant by PPI? 1  
b) Discuss the control word format of 8155. 4  
c) Design a square-wave generator with a pulse width of  $100\mu s$  by using the 8155 timer. Set up the timer in Mode 1 if the clock frequency is 3 MHz. 3.75
7. a) Why BSR mode of 8255A is used? Give an example. 2  
b) Interface 8255A ports in mode 0 with processor for the following conditions: 3  
i. Use port B and port  $C_L$  as input ports to read inputs from DIP switches and port A and port  $C_U$  as output ports to display output at leds.  
ii. Write the program to read the DIP switches and display the reading from port B at port A and from port  $C_L$  at port  $C_U$ .  
c) Draw and discuss the block diagram of 8254 programmable interval timer. 3.75
8. a) Discuss how data is transferred bidirectionally between two computers using port A of 8255A in Mode 2. 3  
b) What is key debounce? How many ways it can be generated? Explain. 2  
c) How a 20-key matrix keyboard is interfaced with processor using an 8255A PPI. 3.75



University of Rajshahi  
Department of Computer Science and Engineering  
B.Sc. Engg. Part-4 (Odd Semester) Examination 2022  
Course: CSE4181 (Digital Image Processing)  
Full mark: 52.5; Time 3 hours  
Answer six questions taking any three from each section

**SECTION A**

1. a) Define digital image. Explain how the image of an object is formed in the eye. 2  
b) Describe three different levels of image processing with examples. 2.75  
c) How does intensity level resolution affect the storage size of digital images? Explain with a quantitative example. 2  
d) You have an image of size 200x200. How much memory is required to store in (i) B/W (ii) grayscale with 30 gray levels (iii) color image with 6 bits quantization. 2
2. a) Explain why the consideration of the problem domain is important in image processing. How many images of size 240x160 with 128 gray levels can be stored in a 512 MB storage space? 3  
b) Differentiate between periodic and non-periodic noise with examples. Explain how periodic noise is suppressed in the frequency domain. 3.75  
c) What is the upper limit of sampling frequency used in digital images? Explain. 2
3. a) Define image enhancement. Mention the key role of image enhancement in image recognition. 3  
b) What is an image histogram? Explain with an example. Which information is carried out by the histogram of an image? 2.75  
c) Draw the histogram of the following image. Equalize the histogram to enhance the image and draw the equalized histogram. 3

10	30	31	7
11	25	17	8
23	11	16	22
25	12	23	14

4. a) Explain linear and non-linear transformations for image enhancement. Suppose you have a gray-level image. You like to enhance the image such that the dark part will be darker and the bright part will be brighter. Which transformation will be suitable to obtain the required outcome? 3  
b) Discuss the effects of mask size on image enhancement. 2.75  
c) Explain gray-level slicing and power law transformation. 3

**SECTION B**

5. a) Briefly describe how the Butterworth filter is implemented in the frequency domain for image sharpening. Compare spatial and frequency domain image filtering. 3  
b) Explain the general equation of spatial filtering. Apply a 3x3 mask on the image shown in 3(c) to implement average filtering without considering the edge pixels' issue. Illustrate the pixel value of the filtered image. 3  
c) What is a weighted smoothing filter? Illustrate with example. Differentiate between correlation and convolution. 2.75
6. a) Mention the limitations of the ideal low-pass filter with the necessary figure. Explain the expression  $H_{hp}(u, v) = 1 - H_{lp}(u, v)$ . 3  
b) When is the restoration process applicable? Differentiate between uniform and impulse noises with necessary examples. 3  
c) Contraharmonic mean filter can be used to remove salt and pepper noises – explain. Mention the advantage of geometric mean over arithmetic mean. 2.75
7. a) How is segmentation important in image processing? Explain the derivative based edge detection is not effective for noisy image. 3  
b) Explain the basic global thresholding algorithm for image segmentation. When is the algorithm effectively applicable? 3  
c) Derive Laplacian mask for edge detection. Mention the situation when log transformation is effective in gray-level transformation. 2.75
8. a) What do you mean by compression of an image? Explain the three redundancies in image compression. 2  
b) Explain the JPEG compression technique. What level of compression can be achieved using JPEG? 3.75  
c) Briefly discuss the lossless predictive coding model. 3