



**Bahria University, Islamabad**  
(Department of Computer Science)  
Final Term Examination  
Class/Section: BSCS-5A & B, MS-0  
(Fall 2022 Semester)

Subject: Design and Analysis of Algorithms  
Course Code: CSC-321  
Instructor: Saima Jawad  
Time Allowed: 2½ Hours

Date: 24-Jan-2023  
Session: I  
Max. Marks: 50  
Total Pages: 2

**Instructions:**

- Attempt all the questions in sequence.
- Do not write anything on the question paper.
- Please return your question paper along with your answer book.

Student's Name: M. Taha Enroll No: 01-134202-048  
(USE CAPITAL LETTERS)

**Question # 1 (15 Marks, 3 each)**

(CLO-1)

- a) Suppose an algorithm belongs to the Cubic complexity class. How much longer will the algorithm run if we double the input size?
- b) Given  $n$  tasks with known running times  $t_1, t_2, t_3, \dots, t_n$ . Suggest a way to schedule these tasks to minimize average completion time?
- c) What are main elements of Dynamic Programming?
- d) Differentiate between P and NP complexity class.
- e) Given the following recursive definition of Binomial Coefficients, compute  $C(3,2)$ .

$$\begin{aligned} C(n,k) &= C(n-1,k-1) + C(n-1,k) && \text{for } n > k > 0 \\ C(n,0) &= C(n,n) = 1 \end{aligned}$$

**Question # 2 (5 Marks)**

(CLO-2)

Consider the following algorithm:

ALGORITHM Guess ( $A[0..n-1, 0..n]$ )  
Input: An  $n \times (n+1)$  matrix  $A[0..n-1, 0..n]$  of real numbers  
for  $i \leftarrow 0$  to  $n-2$  do  
    for  $j \leftarrow i+1$  to  $n-1$  do  
        for  $k \leftarrow i$  to  $n$  do  
             $A[j, k] \leftarrow A[j, k] - A[i, k] * A[j, i] / A[i, i]$

- a) What does this algorithm compute?
- b) Find the asymptotic upper bound of this algorithm in terms of  $n$ .

Question # 3 (10 Marks)

(CLO-2&amp;3)

Write an algorithm to generate optimal binary codes using Huffman's greedy strategy. Assume that a table containing n symbols and their frequency of occurrence is available as an input. Analyze the worst case efficiency of your algorithm?

Question # 4 (3+7 Marks)

(CLO-1&amp;3)

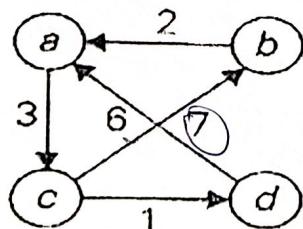
- a) Write an algorithm to explore a node in a state space tree for an optimizing problem.
- b) Five programmers (A, B, C, D and E), in a software house, write five programs each (P1, P2, P3, P4 and P5). Each program runs successfully but takes different time as given in the following matrix. Assuming that only one program of each programmer is to be selected, assign the programmers to the programs in such a way that the total time taken by the programs is minimum. Considering the following time matrix, draw the complete state space tree.

	P1	P2	P3	P4	P5
A	80	66	65	65	73
B	76	75	70	70	75
C	74	73	72	70	66
D	75	75	71	71	73
E	76	66	66	70	75

Question # 5 (10 Marks)

(CLO-1)

Find all pairs of shortest paths for the following graph using Floyd's algorithm. Show complete step by step working.




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*End of Question Paper*

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Bahria University, Islamabad Campus  
Department of Computer Science  
Final Term Examination  
Class/Section: BSCS 6(A,B)  
(FALL 2022 Semester)  
Paper Type: Descriptive

Course: Linear Algebra

Date: 25-1-23

Course Code: GSC-121

Session I

Faculty's Name: Ambrina Kanwal  
& Dr Farzana

Max Marks: 50

Time Allowed: 2.5 hrs

Total Pages: 2(including this)

**INSTRUCTIONS:**

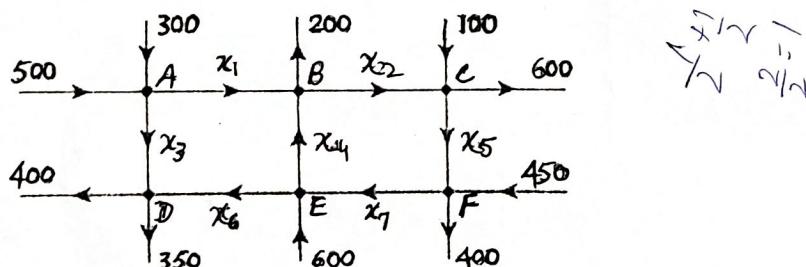
- I. All questions are compulsory.
- II. There are total five questions.
- III. Scientific calculators are allowed, programmable calculators are not allowed.
- IV. Exchange of anything especially calculators are not allowed.
- V. **Return the question paper with your answer sheet**

Student's Name: M. Taha  
(USE CAPITAL LETTERS)

Enrollment No: 01-134202-048

**Question # 1 (10 Marks) PLO3, CLO3**

- a) Given a network in which the flow rate and direction of the flow in branches are known.  
Construct the linear equations for the system for the unknowns, for all nodes.  
(you don't need to solve the system, only linear equations are required).



- b) Find the standard matrix for the transformation given below and use the matrix to compute  $T(x)$ . Check your result by substituting  $x$  directly in the formula for  $T$ .

Where  $T(x, y, z) = (2x - y + z, y + z, 0)$ ; where  $x = (2, 1, -3)$

**Question # 2 (10 Marks) PLO2, CLO3**

- a) Express the following quadratic form in the matrix notation.

$$Q = 9x^2 - y^2 + 4z^2 + 6xy - 8xz + yz$$

- b) Check if the matrix obtained from the quadratic form given above is a

I. Symmetric matrix or not?

II. Orthogonal matrix or not? (Justify your results by using the identities).

$$\begin{pmatrix} \lambda - 9 & -3 & 4 \\ -3 & \lambda + 1 & -1/2 \\ 4 & -1/2 & \lambda - 4 \end{pmatrix}$$

Question # 3 (10 Marks) PLO1, CLO2

- a) Verify that the vectors  $v_1 = (-3/5, 4/5, 0)$ ,  $v_2 = (4/5, 3/5, 0)$ ,  $v_3 = (0, 0, 1)$  form an orthonormal basis for  $R^3$   
 b) let  $R^3$  have the Euclidean inner product, use the Gram-Schmidt process to transform the basis  $\{u_1, u_2, u_3\}$  into an orthogonal basis.  $u_1 = (1, 1, 2)$ ,  $u_2 = (2, 1, 3)$ ,  $u_3 = (1, 0, 1)$

Question # 4 (10 Marks) PLO2, CLO3

- a. Find the eigenvalues of the matrix  $A$  given below.  
 b. For each eigenvalue  $\lambda$ , find the corresponding eigen vectors and find a matrix  $P$  that diagonalizes  $A$ .

$$\begin{bmatrix} -1 & 7 & -1 \\ 0 & 1 & 0 \\ 0 & 15 & -2 \end{bmatrix}$$

Question # 5 (10 Marks) PLO2, CLO3

- a) Check whether the following set of vectors forms a basis for  $R^3$  or not, justify your answers.  
 $S = \{(2, -3, 1), (4, 1, 1), (0, -7, 1)\}$
- b) Find the coordinate vector of  $v = (5, -12, 3)$  relative to the basis  
 $S = \{v_1, v_2, v_3\}$  for  $R^3$  where  
 $v_1 = (1, 2, 3)$ ,  $v_2 = (-4, 5, 6)$ ,  $v_3 = (7, -8, 9)$

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*End of Question Paper*

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**Bahria University, Islamabad Campus**  
**Department of Computer Sciences**  
**Final Term Examination**  
**Class/Section: BS (CS) 5-A & B**  
**Fall 2022**  
**Paper Type: Objective/Descriptive**

Course:	<b>Islamic Studies / Ethics</b>	Date:26-01-2023
Course Code:	ISL-101	Session-I
Teacher Name:	Dr. Abdul Hamid Chishti	Max Marks: 50
Time Allowed:	150 Minutes	Total Pages: 1

**INSTRUCTIONS:**

- i. All question are compulsory.
- ii. There are total 5 questions.
- iii. The paper is closed book.
- iv. Students are not allowed to use any helping material (books, tables, formulas etc)
- v. Use black, blue or blue-black ink only. Do not use lead pencil.

Name: M. Taha  
(USE CAPITAL LETTERS)

Enroll No: 01-134202-048

**Question: 1** Islamic Economic System is unique in itself. Calk out a strategy for the distribution of wealth among the poor and needy people of our society to eradicate poverty.

[CLO-3] [MARKS-10]

**Question: 2** Muslim worlds are facing various contemporary challenges. Identify some major issues and suggest few viable solutions.

[CLO-1] [MARKS-10]

**Question: 3** Write a short note on the following:

- a. The institution of family in social system of Islam.
- b. Ethical values as described in *Surah Al-Hujraat* and *Surah Al-Furqan*.

[CLO-4] [MARKS-5+5]

**Question: 4** Islam teaches to live with peace and harmony with non-Muslims, give your opinion by providing references of Islamic teachings and ethical values.

[CLO-2] [MARKS-10]

**Question: 5** Choose any three Muslim Scientists and substantiate their contribution in scientific domain.

[CLO-4] [MARKS-10]

**Good Luck**



**Bahria University, Islamabad Campus**  
**Department of Computer Science**  
**Final Term Examination**  
**Class/Section: BSCS-5 (A/B)**  
**(Fall 2022 Semester)**  
**Paper Type: Descriptive**

Course: Software Engineering

Date: 29-1-2023

Course Code: SEN-220

Time: 10:00-12:30

Faculty's Name: Zeeshan Aslam/Anum Kaleem

Max Marks: 50

Time Allowed: 150 minutes

Total Pages: 3

**INSTRUCTIONS:**

- I. The paper is closed book.
- II. There are total *Four* questions. All questions are compulsory.
- III. Marking would be *relative* to the answers.
- IV. Students have to *return question paper* with answer sheet.
- V. **Spend some time to understand the questions and briefly answer the questions.**
- VI. Use appropriate notations and follow the rules and conventions for drawing Use Case, Activity diagrams and Sequence diagram.

Student's Name: M. Taha Enroll No: 01-134202-048  
(USE CAPITAL LETTERS)

**Question # 1:** (21 Marks 3 each)

- a) Differentiate between Forks and swim lanes considering activity diagrams with the help of an example.
- b) Differentiate between include and extend relationships in use case diagrams with the help of an example
- c) Differentiate between association and generalization in regards to use case diagrams with the help of an example
- d) What notations are used to specify synchronous and Asynchronous communication in a sequence diagram
- e) Differentiate between black box, white box and grey box testing.
- f) Differentiate between agile development and Extreme programming.
- g) Differentiate between FF and SS relation in a Gantt chart. Justify with example

**Question # 2**

(CLO-4) (18 Marks 3 + 6 + 6 +3)

Answer the following questions considering the case study given below.

**Case Study:** JazzN!ghts is a famous Jazz festival, held in Zurich every year. Since its first edition in 1986, it has gone through several major changes regarding its structure, length and location; but the tickets have always been sold in a traditional way: through two events agencies. The organizers decided to completely modernize the tickets selling system and created the following concept.

From this year on, the tickets will be sold in three distinct ways: traditionally, i.e. by the two events agencies, in electronic format directly on the festival website, and through SBB. All parties will have access to the same unique tickets database of the new system, to avoid double selling. A partnership with the SBB railway company needs to be set up, such that SBB can sell combi-tickets including both the festival admission fee and the train ride to the festival venue at reduced price, from anywhere in Switzerland. This way, more music fans would have easier and cheaper access to JazzNights. Moreover, the system will have to be extended to support not only German, but also English, French and Italian. Since tickets will also be sold online, SecurePayment Inc. will be contracted to provide and ensure the security of the online payment service. The JazzNights event manager will take care and negotiate all these details with the involved parties. Additionally, upon arrival at the festival venue, each participant has to self-check in at a touch screen terminal, which scans the barcodes on his/her ticket and issues a bracelet with an electronic chip. This can be used to load money, such that whenever (s)he wants to purchase snacks or beverages, (s)he does not have to use cash any more, thus reducing waiting times. This measure was initiated by the program manager and will be deployed by WristSolutions Inc. Lastly, according to the cantonal laws, the way the payment transactions are performed has to be audited by an external company at the end of the festival, since this is a public event, where the municipality of Zurich is also involved - allowing free use of the public space.

- List the primary and secondary stakeholder of the above system.
- Draw Use Case Diagram for JazzNights new tickets selling system.
- Draw Activity Diagram for JazzNights new tickets selling system. Include Swimlanes to clearly show the division of responsibilities.
- Write Use Case Tabular description for "Issue a Bracelet" use case.

**Question # 3****(CLO-4) (6 Marks)**

Sketch a Sequence diagram for the following Signup and Log-In interface.

**Sign Up**

First Name	<input type="text"/>
Last Name	<input type="text"/>
Email	<input type="text"/>
Password	<input type="text"/>
Confirm Password	<input type="text"/>
<input type="button" value="Submit"/>	

**Log In**

Email	<input type="text"/>
Password	<input type="text"/>
<input type="button" value="Submit"/>	

Enrollment Number: \_\_\_\_\_

**Question # 4**

**(CLO-4) (5 Marks)**

Create Gantt Chart for the following activity and durations mentioned below. The total time duration for the project is 17 days.

Activity	Predecessor	Time
A	None	2
B	A	3
C	B	4
D	C (FS2)	4
E	C (SS3)	1
F	C	1
G	C	3
H	D, E, F, G	2
I	F, G	1
J	H, I	2
K	J (FF2)	1



**Bahria University, Islamabad Campus**  
**Department of Computer Sciences**  
**Final Term Examination**  
**Class/Section: BSCS/ (5A, 5B)**  
**(Fall 2022 Semester)**  
**Paper Type: Descriptive**

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Course: **Operating Systems** Date: **31/01/2023**  
Course Code: **CS320** Time: **10:00am to 12:30pm**  
Faculty's Name: **Sabira Feroz** Max Marks: **50**  
Time Allowed: **2.5 hours.** Total Pages: **2**

**INSTRUCTIONS:**

- Return the question paper with your answer sheet.
  - There are a total of five questions in the question paper. All questions are compulsory.
  - Don't use lead pencil and be neat.
  - Read all the questions carefully and make sure that you know what you are being asked to do.
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Student's Name: M Wasif  
(USE CAPITAL LETTERS)

Enroll No: 01-134701-090

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Question # 1 (10 Marks) .....(CLO-1)

A system has four resources A, B, C, and D. The total number of instances of each type is 3, 14, 12, and 12 respectively. Consider the following snapshot of a system:

	<i>Allocation</i>	<i>Max</i>
	<i>A B C D</i>	<i>A B C D</i>
P0	0 0 1 2	0 0 1 2
P1	1 0 0 0	1 7 5 0
P2	1 3 5 4	2 3 5 6
P3	0 6 3 2	0 6 5 2
P4	0 0 1 4	0 6 5 6

Answer the following questions using the banker's algorithm:

- a. What is the content of the matrix *Need*?
- b. Is the system in a safe state?
- c. If a request from process *P1* arrives for (0,4,2,0), can the request be granted immediately?

Question # 2 (10 Marks) .....( CLO-2)

What is paging and why it is needed? If a process size is 16KB, page size 2000B and memory size 4KB.

- How many bits are required in the logical address?
- How many bits are required in the physical address?
- How MMU maps the addresses using page table and also show the logical and physical address space for position 2.

Question # 3 (10 Marks) .....( CLO-3)

Why race condition occurs in the computer systems. Suppose, there is a banking system which have two methods: deposit (amount) and withdraw (amount). These two methods have amount as a parameter that is to be deposited or withdrawn from a bank account. Assume that two partners share a bank account and one partner calls the withdraw () method and the other one calls the deposit () method concurrently. Describe how a race condition is possible and what might be done to prevent the race condition from occurring. Write the pseudo code for the solution.

Question # 4 (10 Marks) .....( CLO-2)

In threads, does fork () system call duplicate only the calling thread or all threads? Suppose that there are hundreds of requests on a server from the clients, creating a thread to service each request is not feasible then how the requests could be handled?

Question # 5 (05+05 Marks) .....(CLO-3)

- Servers can be designed to limit the number of open connections. For example, a server may wish to have only N socket connections at any point in time. As soon as N connections are made, the server will not accept another incoming connection until an existing connection is released. Which synchronization algorithm can be used by server to limit the number of concurrent connections and explain how it can be used?
- Assuming a 1-KB page size, what are the page numbers, offsets and the bits for logical address of following:
  - 214201 B
  - 31190 B
  - 650002 B

Best of Luck!!

*End of Question Paper*

Question # 1 (15 Marks)

Consider there is a system which have three types of resources A, B and C. A has 4 instances. B has 5 instances and C has 3 instances. Consider there are six processes P0, P1... P5.

Processes	Allocation			Maximum Need		
	A	B	C	A	B	C
P0	1	2	0	2	2	2
P1	1	0	0	1	1	0
P2	1	1	1	1	4	3
P3	0	1	1	1	1	1
P4	0	0	1	1	2	2
P5	1	0	0	1	3	1

Illustrate that the system is in safe state or not. If the system is in safe state, then demonstrate the order in which the processes may complete.

#### Question # 4 (10 Marks)

*Why race conditions occur in computer systems.* Suppose there is a banking system which has two methods deposit (amount) and withdraw (amount). These two methods have amount as a parameter that is to be deposited or withdrawn from a bank account. Assume that two partners share a bank account and one partner calls the withdraw () method and the other one calls the deposit () method concurrently. Describe how a race condition is possible and what might be done to prevent the race condition from occurring. Write the pseudo code for the solution.

Question # 2 (15 Marks)

What is paging and why it is needed? If a process size is 4KB, page size 2KB and memory size 16KB.

- a. How many bits are required in the logical address?
- b. How many bits are required in the physical address?
- c. How MMU maps the addresses using page table and also show the logical and physical address space for position 2.

Question # 3 (10 Marks)

- a. Why inverted page tables are used and what could be the possible advantages and disadvantages of using inverted page tables in comparison with page tables.
- b. Assuming a 1-KB page size, what are the page numbers, offsets and the bits for logical address of following:
  - i. 3085 B
  - ii. 42095 B
  - iii. 215201 B