



Tanta
University

Computers & Control Engineering Department



Faculty of Engineering

Course Title	Digital Signal Processing	Academic Year 2022/2023	Course Code	CCE3116
Year/ Level	Third	<u>First Semester Exam</u>	Total Marks	70
Date	12/1/2023	No. of Pages (2)	Allowed time	3 hrs
Remarks: Answer all the following questions فقط ممنوع استخدام القلم الرصاص في الإجابة إلا بغرض الرسم				

Question Number (1) (23 Points)

- a) Check whether the following systems are static, linear, shift invariant, causal, and stable or not: **(5 points)**

(1) $y_1(n) = 2n + x(n^2 + 2)$ (2) $y_2(n) = (2)^{n-1} x(2n - 3)$

- b) Consider the following discrete-time sequence: **(8 points)**

$$x((n))_8 = \{1, 2, 0, -1, -2, -3, 0, 4\}$$

Find in the sequence form:

- (1) $y_1(n) = x((-n))_8$
 (2) $y_2(n) = x((-n - 3))_8$
 (3) $y_3(n) = x((3 - n))_8$
 (4) $y_4(n) = x((2n - 1))_8$

- c) **Complete the following sentences:** **(10 Points)**

- The Z-Transform for the sequence $x(n + 2)$ is
- By checking the causality of a system that has a unit sample response $h(n) = \{4, -2, 0, 3, 1\}$, the system is
- The filters that have digital transfer functions consist of zeros and poles are referred to as
- is used to reject a specific band of frequencies.
- Using butterfly computation, the 2-point DFT of the discrete time sequence $x(n) = \{4, -2\}$ is
- The type of system that needs a memory for its operations is called
- Considering $N = 16$, the number of complex multiplications that are required to compute the 16-point DFT using the direct method is....., where this number is reduced to be using the Radix-2 DIT-FFT algorithm.
- When the sequences are periodic, the convolution is
- Using the initial value property of Z-Transform for $X(z) = \frac{6z^2}{(z+1)(z^2-z+0.25)}$, $x(0) = \dots\dots\dots$



D 14

Question Number (2) (24 Points)

a) Find the inverse Z-Transform of the following functions: **(12 points)**

1. $X(z) = 2 Z^{-1} + \frac{Z+4}{Z^2-1.5 Z+0.5}$

2. $X(z) = \frac{Z-1}{(Z-3)^2} + \frac{Z}{(Z^2+1)}$

b) Compute the circular convolution, $y(n) = x_1(n) \circledast x_2(n)$, **(6 points)**

where: $x_1(n) = \{1, -1, -3, 4, 1\}$

$x_2(n) = \{2, 0, 2, -1, 1\}$

c) Determine the 4-point DFT of the following sequence: **(6 points)**

$x(n) = \{1, 0, -1, 2\}$

Sketch the magnitude and phase of the result 4-point DFT

Question Number (3) (23 Points)

a) Using Radix-2 DIT-FFT algorithm, obtain the 8-point DFT of the following sequence: **(9 points)**

$x(n) = \{2, -1, 0, 2, 1, 0, -1, -1\}$

Follow exactly the corresponding signal flow graph and show all of the intermediate calculations on the graph.

b) Using Butterworth approximation for analogue filters design, derive the general transfer function for the third order normalized low pass filter (NLPF). **(7 points)**

c) Design a second order digital low pass filter with cutoff frequency 20 Hz and sampling rate 60 Hz. **(7 points)**

End of questions.....

Dr. M. Arafa

$x(n)$	$X(z)$	$x(n)$	$X(z)$	$x(n)$	$X(z)$
$\delta(n)$	1	$u(n)$	$\frac{z}{z-1}$	$n a^n$	$\frac{a z}{(z-a)^2}$
a^n	$\frac{z}{z-a}$	e^{-an}	$\frac{z}{z-e^{-a}}$	n	$\frac{z}{(z-1)^2}$
$\sin(wn)$	$\frac{z \sin(w)}{z^2 - 2z \cos(w) + 1}$	$\cos(wn)$	$\frac{z(z - \cos(w))}{z^2 - 2z \cos(w) + 1}$		

Course Title: Control Engineering
Date: 15-1-2023 (First term exam)

016

Course Code: CCE3115
Allowed time: 3.0 hrsYear: 3rd
No. of Pages: (2)**Question (1) (20 Marks)**

a) When the unity feedback second order system with open loop transfer function, which is given by $\left(G(s) = \frac{\omega_n^2}{s(s + 2\zeta\omega_n)} \right)$, is subjected to a unit-step input, the system response

contains overshoot of 77%, occurring after time of 0.0325 (sec.) has elapsed. **Calculate:**

- The rise time and the time to settle down to within 2% of the final value.
 - The steady-state error (e_{ss}) for unit-step, unit ramp, and unit-parabolic inputs.
- b) A unity feedback closed-loop system has open-loop transfer function which is given by:

$$G(s) = \frac{2k}{s(s+1)(s+2)}$$

What is the minimum value of (k) for ($e_{ss} \leq 0.1$).

Question (2) (25 Marks)

Consider a unity feedback system shown in Fig. 1. The dynamic gain k varies from zero to infinity.

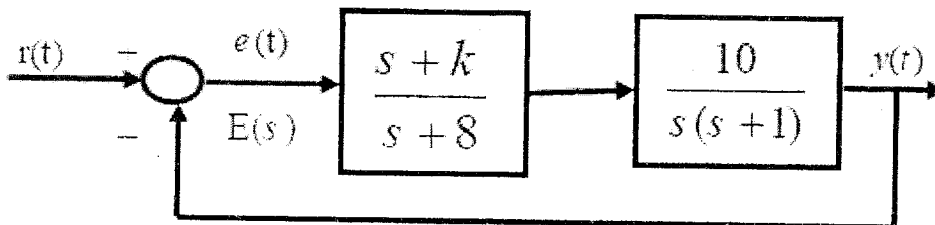


Fig. 1 Unity negative feedback system

- Sketch the root locus of the system
- Find the value of dynamic gain k such that the corresponding closed loop poles have a damping ratio 0.5

Question (3) (30 Marks)

a) Consider the problem of designing PID controller for the open-loop control system with forward loop transfer function that is given by:

$$G(s) = \frac{1}{s(s+2)(s+4)}$$

By using the **Ziegler-Nichols (Z-N)** tuning method:

- Design PID controller.
- Draw the electronic circuit of PID using operational amplifiers.

b) Consider a unity-feedback control system with an open-loop transfer function of:

$$G(s) = \frac{k}{s^2(s+1.5)}$$

Design a phase lead compensator that is to be introduced in the forward path to achieve the desired performance specifications

- i) Maximum overshoot is less than or equal to 20%.
- ii) Settling time is less than or equal to 8 sec.

Good luck



D17



Tanta University

Department: Control and Computers Dept.
(100Marks)

Faculty of Engineering

Course Title: Compilers and Languages

Course Code: CCE3113

Date: 22/1/2023(Final First Term 2023)

Model **A**

Allowed Time: 3 hours

Question 1: (35 Marks) Choose the right answer.

- How many distinct string and parse trees can be generated by the following grammar?
 $S \rightarrow A1 \mid 1B$
 $A \rightarrow 10 \mid C \mid \epsilon$
 $B \rightarrow C1 \mid \epsilon$
 $C \rightarrow 0 \mid 1$
 - 4 strings, 7 parse trees
 - 5 strings, 6 parse trees
 - 5 strings, 7 parse trees
- Who is responsible for the creation of the symbol table?
 - Assembler
 - Interpreter
 - Compiler
- The regular expression denotes a language comprising all possible strings of even length over the alphabet (0, 1).
 - $1 + 0(1+0)^*$
 - $(00+0111+10)^*$
 - $(1+0)$
- When there is a reduce/reduce conflict?
 - If a state does not know whether it will make a shift or reduction operation using the production rule i or j for a terminal
 - If a state does not know whether it will make a reduction operation using the production rule i or j for a terminal
 - If a state does not know whether it will make a shift operation using the production rule i or j for a terminal
- Finite state machines recognize nested structures
 - Can
 - Can't
- A grammar that produces more than one parse tree for some sentence is called.....
 - Unambiguous
 - Ambiguous
 - Regular
- In regular expressions, the operator '*' stands for?
 - Iteration
 - Concatenation
 - Addition
- Any string of terminals that can be generated by the following CFG is: $S \rightarrow XY$
 $X \rightarrow aX \mid bX \mid a$
 $Y \rightarrow Ya \mid Yb \mid a$
 - has at least one 'b'
 - should end with 'a'
 - May has consecutive a's or b's
- Choose the grammar that correctly eliminates left recursion from the given grammar:
 $E \rightarrow E + T \mid T$
 $T \rightarrow id \mid (E)$
 - $E \rightarrow E' + T \mid T$
 $E' \rightarrow id \mid (E)$
 $T \rightarrow id \mid (E)$
 - $E \rightarrow id + E \mid E + T \mid T$
 $T \rightarrow id \mid (E)$
 - $E \rightarrow TE'$
 $E' \rightarrow +TE' \mid \epsilon$
 $T \rightarrow id \mid (E)$
- Following context free grammar
 $S \rightarrow aB \mid bA$
 $A \rightarrow a \mid aS \mid bAA$
 $B \rightarrow b \mid bS \mid aBB$
 - equal number of a's and b's
 - odd number of a's and odd number of b's
 - even number of a's and even number of b's

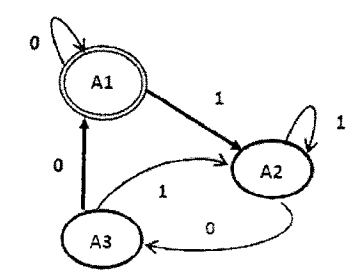
- Consider the grammar defined by the following production rules:
 $S \rightarrow T * P$
 $T \rightarrow U \mid T * U$
 $P \rightarrow Q + P \mid Q$
 $Q \rightarrow id$
 $U \rightarrow id$
 - + is Left associative, while * is right associative.
 - + is Right associative, while * is left associative

- The CFG: $S \rightarrow aS \mid bS \mid b \mid a$ is equivalent to regular expression:
 - $(a+b)$
 - $(a+b)(a+b)^*$
 - $(a+b)(a+b)$
 - None.

- What is a compiler?
 - system program that converts instructions to machine language
 - system program that converts machine language to high-level language
 - Target code

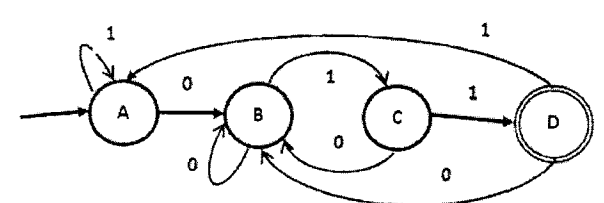
- For the following two regular languages $L1 = (a+b)^*a$ and $L2 = b(a+b)^*$, the intersection of $L1$ and $L2$ is given by:
 - $(a+b)^*ab$
 - $a(a+b)^*b$
 - $b(a+b)^*a$
 - $ab(a+b)^*$

- Regular expression corresponding to the state diagram given in the following figure is:



- $(0+1(1+01)^*00)^*$
- $(1+0(0+10)00)^*$
- $(1+0(1+00)11)^*$

- NFAs are DFAs.
 - Larger than
 - Equally expressive as
 - Less expressive than
- Which of the following is a part of a compiler that takes as input a stream of characters and produces as output a stream of words along with their associated syntactic categories?
 - Optimizer
 - Scanner
 - Parser
- What is the grammar for the below equations?
 $S \rightarrow CC$
 $C \rightarrow cC \mid d$
 - LL(1)
 - SLR(1) but not LL(1)
 - LALR(1) but not SLR(1)
- The following context free grammar generates strings of terminals that have $S \rightarrow SS \mid 0S1 \mid 1S0 \mid \epsilon$
 - Number of zeros followed by any number of ones.
 - Equal number of 0's and 1's.
 - Unequal number of 0's and 1's.
- The input of code generator is
 - Source code
 - Intermediate code
 - Target code
- In the following figure a deterministic finite automation M, Which of the following regular expressions denoted the set of all words accepted by M?



- 10^*1^*0
- 001
- $(0|1)^*011$
- 1^*0^*001

22. Which of the following statements is false?

- (a) Unambiguous grammar has both kind of derivations
- (b) An LL(1) parser is a top-down parser
- (c) Ambiguous grammar can't be LR(k)

23. What does a top-down parser generate?

- (a) Rightmost Derivation in reverse.
- (b) Leftmost Derivation in reverse.
- (c) Leftmost Derivation.
- (d) Rightmost Derivation.

24. Which of the following error can Compiler diagnose?

- (a) Logical errors only
- (b) Grammatical and logical errors
- (c) Grammatical errors only

25. Which of the following grammars are **Not** ambiguous?

- (a) $S \rightarrow aSb \mid AA., A \rightarrow c \mid S.$
- (b) $S \rightarrow aSbS \mid aS \mid c.$
- (c) $S \rightarrow aSbc \mid AB., A \rightarrow a., B \rightarrow a.$

26. Which of these is also known as look-head LR parser?

- (a) SLR
- (b) LR
- (c) LLR

27. Shift reduce parsers are

- (a) May be top down or bottom up
- (b) Top down Parser
- (c) Bottom Up parser

28. Which of the following phase of the compiler is Syntax Analysis?

- (a) Second
- (b) Third
- (c) First

29. The source code are defined as:

- (a) Preprocessor
- (b) assembler
- (c) Linker

30. How many strings does the following grammar generate?

$A \rightarrow BB$
 $B \rightarrow CC$
 $C \rightarrow 1 \mid 2.$

- (a) 8
- (b) 16
- (c) 12
- (d) 32

31. Which of the following error can a compiler check?

- (a) Logical Error
- (b) Syntax Error
- (c) Compiler cannot check errors

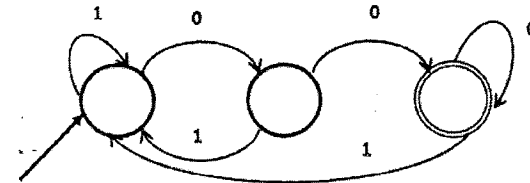
32. Which of the grammars are ambiguous?

- (a) $S \rightarrow 0S1 \mid 01$
- (b) $S \rightarrow +SS \mid -SS \mid a$
- (c) $S \rightarrow a \mid S+S \mid SS \mid S^* \mid (S)$

33. Which of the following concept of FSA is used in the compiler?

- (a) Code generation
- (b) Lexical analysis
- (c) Parser

34. The regular language that denotes the same language as this finite automation is:



- (a) $(0+1)^*00$
- (b) $(0+1)^*$
- (c) $(1^*+0)(1+0)$

35. Which of the following suffices to convert a CFG to an LL(1) grammar?

- (a) Removing Left recursion only.
- (b) Factoring a grammar alone.
- (c) Factoring and left recursion removal.
- (d) None of the mentioned

1. If L is a regular language then its kleene closure L^* will also be a regular language.

2. LR parsing is one type of top down parsing. It is used to parse the large class of grammars.

3. In the left most derivation, the input is scanned and replaced with the production rule from left to right.

4. The given RE $(x+y)^*$ has none or many instances of an x or y

5. a successful parse means the input is semantically correct.

6. Derivation is used to get the input string through the production rules.

7. Finite state machine is used to recognize patterns.

8. All Finite State Machines can have only one edge leaving the same state labeled with the same label (character).

9. A regular expression is a type of pattern used to classify lexemes.

10. Formal grammar is used to generate all possible strings over the alphabet that is syntactically correct in the language.

11. Parsing is categorized into two main types.

12. The following grammar with terminals $T = a, b.$ $S \rightarrow Sa \mid b,$ can be recognized by a recursive descent parser

13. Regular expressions cannot be used to match strings of a balanced parentheses.

14. Parse Tree is the graphical representation of symbol that can be terminals or non-terminals.

15. Scanner don't know anything about the grammar of a language.

16. In the right most derivation, the input is scanned and replaced with the production rule from right to left.

17. In the SLR (1) parsing, we place the reduce move only in the follow of right hand side.

18. Finite State Machines can have an unlimited number of states.

19. Code Optimization removes the unnecessary lines of the code and arranges the sequence of statements in order to speed up the program execution.

20. you can change state in a DFA without reading any input character.

21. A grammar is said to be unambiguous if there exists more than one leftmost derivation or more than one rightmost derivative or more than one parse tree for the given input string.

22. RE can be used only for values of type string and number.

23. Syntax tree is usually used when represent a program in a tree structure.

24. Every DFA has a regular expression denoting its language.

25. The regular expression $(0+1)^*00(0+1)^*$ with all strings of 0s and 1s with at least two consecutive 0s.

26. Lexical analysis is recursive in order to Handel nested parentheses.

27. The RE $\{0^* + 1 + 2\}$ in which any number of 0s is followed by any number of 1s followed by any number of 2s is?

28. Top down parser constructs the parse tree from the start symbol and transforms it into the input symbol.

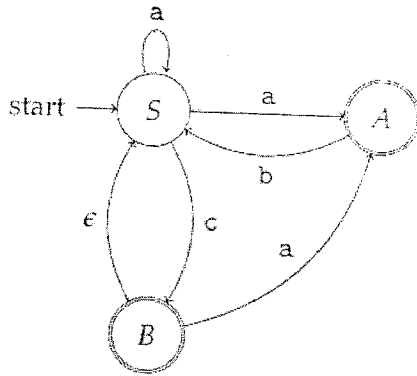
29. This context free grammar is ambiguous, $S \rightarrow Ab \mid aaB.$
 $A \rightarrow a \mid Aa.$
 $B \rightarrow b.$

30. In semantic analysis phase, the parser checks that the expression made by the tokens is syntactically correct or not.

Question 3: (35 Marks)

1. (5 mark) Consider the following NFA, with start state S, terminals {a, b, c}, and final state A and B.

Question 2: (30 Marks) True/False



Construct a DFA (Deterministic Finite Automaton) that accepts the same language.

2. (5 marks) Consider the following context free grammar for expressions made of the terminals symbols: $\{a, b, <, >, ?, !, @, [,]\}$: $E \rightarrow UV \mid EBE \mid V \mid [E]$

$V \rightarrow a \mid b$

$U \rightarrow < \mid >$

$B \rightarrow ? \mid ! \mid @$

Is this grammar as given ambiguous? If yes, give an example of an expression with two parse trees under this grammar. If not, explain why?

3. (5 marks) Given is the following left-recursive grammar.

$S \rightarrow aSb \mid Sba \mid A.$

$A \rightarrow Aa \mid bS \mid c.$

Construct the grammar in which left-recursion is removed.

4. (20 marks) Write the First and Follow set for the following production Rules:

$S \rightarrow aBDh$

$B \rightarrow cC$

$C \rightarrow bC \mid \epsilon$

$D \rightarrow EF$

$E \rightarrow g \mid \epsilon$

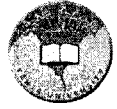
$F \rightarrow f \mid \epsilon$

Draw the Parsing Table and Draw the SLR if it possible.

End of Exam ... With my best wishes...

Dr. Tahani Allam

2023



Course Title	Operating Systems	Academic Year 2022/2023	Course Code	CCE3114
Year/ Level	Third Year	First -Semester Exam		
Date	24-1-2023	No. of Pages (3)	Allowed time	3 hrs

Remarks: MODEL (A)

(Answer ALL the following questions)

Questions # 1,2,3 and 4 must be answered in the attached answer-booklet

Question # 5 must be answered in the attached bubble sheet

You can assume any missing parameter values and state this clearly in your answer

Question Number (1)

(20 Points)

A. Consider three collaborative robots (R1, R2 and R3) in the same production line. The robots use two conveyors (C1 and C2) according to the following pattern.

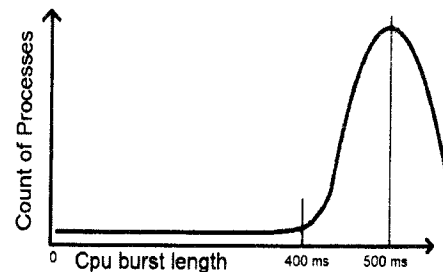
- 1- Robot R1 places empty bottles on conveyor C1.
- 2- Robot R1 takes bottles from conveyor C1 one by one, fills up each bottle with mineral water and place it on conveyor C2.
- 3- Robot R2 takes filled up bottles from conveyor C2 one by one, close the bottle with a suitable cap.
- 4- Each conveyor has a sensor that can inform the robot by the number of bottles on this conveyor.

Propose a solution to this problem illustrating your answer by **writing a pseudo code program**.

(10 Points)

B. Consider the following chart of some common scientific processes, what is the best CPU scheduling algorithm you should select from the following algorithms to achieve the best turnaround time (FCFS – Shortest remaining time first- Round robin with time quantum=10 ms)? **Justify your answer?**

(10 Points)



Question Number (2)

(20 Points)

a) Consider the following information about processes (P1 to P5):

Process	Arriving Time	CPU Burst-Time	Priority
P1	0	9	3
P2	3	5	2
P3	5	5	1
P4	7	3	1
P5	8	3	0

Draw the Gantt chart, then calculate the average waiting time, and the average response time for each of the two following scheduling algorithms:

NOTES:

- The lowest integer represents the highest priority

- I. First Come First Serve (FCFS) scheduling algorithm **(5 Points)**
- II. **Nonpreemptive** Shortest Job First (SJF) scheduling algorithm **(5 Points)**



- III. **Nonpreemptive** Shortest Job First (SJF) with priority algorithm **(5 Points)**
- IV. **Preemptive** Shortest Remaining Time First with priority algorithm **(5 Points)**

Question Number (3)

(20 Points)

a) Suppose we have a magnetic disk with the following parameters: **(10 Points)**

Average seek time	12 ms
Rotation rate	7200 RPM
Transfer rate	4 M Byte/second
Controller overhead	2 ms
Number of sectors per track	64
Sector size	512 Bytes

- I. Calculate the average time to read a single sector.
- II. Calculate the average time to read 16KB in 32 consecutive sectors in the same cylinder.

b) Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 400, and the previous request was at cylinder 450. The queue of pending requests, in FIFO order, is:

2530; 1320; 2496; 2800; 459; 1722; 245; 1360; 4965; 3577

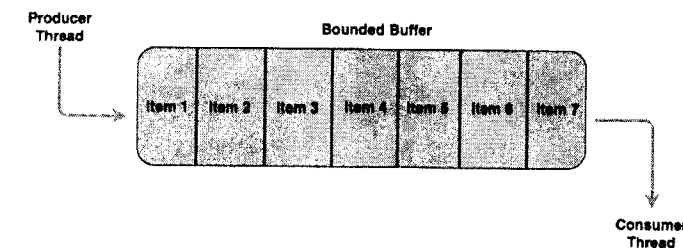
Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?

- I. FCFS
- II. SCAN
- III. C-SCAN
- IV. SSTF

Question Number (4)

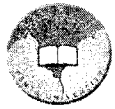
(10 Points)

A blocking queue is defined as a queue which blocks the caller of the enqueue method if there's no more capacity to add the new item being enqueued. Similarly, the queue blocks the dequeue caller if there are no items in the queue. Also, the queue notifies a blocked enqueueing thread when space becomes available and a blocked dequeuing thread when an item becomes available in the queue.



Write a C# or C++ class called **BlockingQueue** showing the code of constructor, enqueue, and dequeue operations **using the required synchronization tools you have studied**.

Then write your code to show how to deal with an objects of that class by creating two threads, one thread for adding int items to the queue ex: {2,5,7,3,5,6} and the other for consuming these data.



Question Number (5) Choose the correct answer (15 Points)

- 1- amount of time it takes from when a request was submitted until the first response is produced
A- Throughput B- Response time C- CPU Utilization D- Turnaround time
- 2- An I/O bound program will typically have
A- a few very short CPU bursts B- many very short I/O bursts C- many very short CPU bursts D- a few very short I/O bursts
- 3- The strategy of making processes that are logically runnable to be temporarily suspended is called
A- Non preemptive scheduling B- Preemptive scheduling C- Shortest job first D- First come First served
- 4- Is the process of copying information into faster storage system
A- Caching B- Compression C- Uploading D- Mirroring
- 5- Scheduling Algorithms try to
A- Minimize waiting time B- Maximize response time C- Minimize CPU utilization D- Minimize throughput
- 6- Applications are Operating System Specific because of the uniqueness of
A- Memory size B- File systems C- System Calls D- CPU registers
- 7- Disk is the total number of bytes transferred, divided by the total time between the first request for service and the completion of the last transfer.
A- Scheduling B- Throughput C- Efficiency D- Bandwidth
- 8- When multiple users or multiple jobs running concurrently, resources must be each of them
A- Installed to B- Approved for C- Prevented from D- Allocated to
- 9- Single-threaded process has one specifying location of next instruction to execute
A- PCB B- Parameter C- Variable D- Program Counter
- 10- Stores Information associated with each process
A- PCB B- FTP C- UDP D- TCP
- 11- Is a Scheduling problem when lower-priority process holds a lock needed by higher-priority process.
A- Aging B- Priority Inversion C- Deadlock D- Starvation
- 12- How can you change the owner of a file and the group it belongs to in Linux at the same time?
(a) `chmod owner:group file.txt` (b) `chmod owner file.txt`
(c) `chmod group file.txt` (d) `chown owner:group file.txt`
- 13- How can you add the x permission to a file for the owner in Linux?
(a) `chmod u+x file.txt` (b) `chmod g+x file.txt`
(c) `chmod o+x file.txt` (d) `chmod a+x file.txt`
- 14- Using a single command, How can you display a list of all the files in the current directory on your terminal and write the output to a file called list.txt?
(a) `ls | tee list.txt` (b) `tee list.txt < ls` (c) `tee list.txt ls` (d) `ls > list.txt`
- 15- The Linux operating system sends signals to processes when you use the command
(a) kill (b) send (c) sendsig (d) ps

End of questions.....

Dr. Reda Elbasiony



Course Title	Fundamentals of Stochastic Process	Academic Year 2022/2023	Course Code	CCE3117
Year/ Level	Third		Total Marks	70
Date	17-1-2023	No. of Pages (3)	Allowed time	3 hrs
Remarks: Answer all the following questions - ممنوع استخدام القلم الرصاص في الإجابة إلا بغرض الرسم فقط				

Question Number (1)

(15 Points)

a) Choose the correct answer and explain your answer: **(5 points)**

- A committee of three is chosen from five councillors - Adams, Burke, Cobb, Dilby and Evans. What is the probability of that Evans is not on the committee?

a) 1/5	b) 2/5
c) 1/2	d) 3/5
- A card is chosen at random from a pack of 52 playing cards. What is the probability of a King and a Heart?

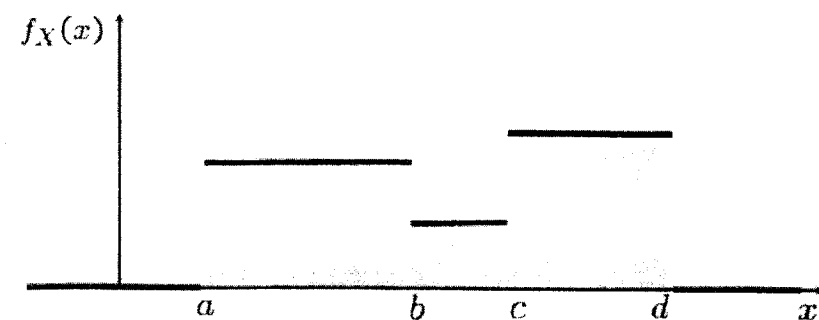
a) 1/52	b) 2/13
c) 4/13	d) 17/52
- A number is chosen at random from the set of two-digit numbers from 00 to 99 inclusive. What is the probability the number contains at least one digit 2?

a) 17/90	b) 1/5
c) 19/100	d) 9/50
- Two fair dice are thrown. What is the probability that the score on the first die is 6 or the score on the second die is 6?

a) 1/36	b) 11/36
c) 1/3	d) 13/36
- In a class of 29 children, 15 like history and 21 like math. They all like at least one of the two subjects. What is the probability that a child chosen at random from the class likes math but not history?

a) 7/29	b) 14/29
c) 15/29	d) 21/29

b) Given a continuous random variable X with uniform probability distribution as shown below. If an event A is said to be occurred. Where $A = b < X < c$ Find: **(10 points)**



- $f_{X|A}(x)$
- $E[X|A]$
- $var(X)$
- $P(a < X < \frac{b}{2})|A$

Question Number (2)

(15 Points)

- a) A and B are independent events having, $P(A)=1/3, P(A \cup B) = 2/3$. Then, Find: **(5 points)**
- $P(B)$
 - $P(A \cap B)$
 - $P(A \cup B^c)$
 - $P(A|B)$
 - $P(B^c|A)$
- b) We have three boxes, namely A, B and C. Box A contains 5 apples, 3 are defected. Box B contains 4 oranges, 1 is defected. Box C contains 10 peaches, 4 are defected. A fruit is drawn randomly from each box. **(10 points)**
- What is the probability that all fruits are defected?
 - What is the probability that all fruits are not defected?
 - What is the probability that only one fruit is defected?
 - If only one fruit is defected, what is the probability that the apple is defected?
 - If only one fruit is defected, what is the probability that the orange is defected?

Question Number (3)

(15 Points)

- a) A biased coin with $P(H) = \frac{2}{3}$ is tossed three times. Let X be the random variable denoting the number of heads which occurs. Find: **(5 points)**
- The probability mass function.
 - Expected value $E[X]$.
 - Variance $var(X)$.
 - The cumulative distribution functions.
- b) Let X and Y be discrete r.v.s. The joint PMF of X and Y is given below. **(5 points)**

		X		
		1	3	5
Y	2	0	1/3	1/12
	4	1/9	1/6	1/9
	6	1/36	1/6	0

- Find $P(X = 3, Y = 4)$
- Find $P(X = 3)$
- Find $P(Y \geq 4)$
- Find the conditional distribution of Y given $X = 3$

c) If a r.v. X has an expectation of $E[X] = 3$, and a variance $\text{var}(X) = 5$. Y is another r.v. where $Y = 2X + 10$. Find: **(5 points)**

1. $E[Y]$.
2. $E[X + Y]$
3. $\text{var}(Y)$.
4. $E[XY]$, If X and Y are independent.
5. $\text{var}(X + Y)$, If X and Y are independent.

Question Number (4)

(20 Points)

a) Let X be a random variable with standard normal distribution $\Phi(x)$. Find: **(10 points)**

1. $\Phi(1.22)$
2. $\Phi(-0.75)$
3. $P(-0.75 \leq x \leq 0)$
4. $P(-1.27 \leq x \leq 2.31)$
5. $P(|x| \leq 0.1)$

b) Let continuous r.v.s X and Y has joint pdf: **(10 points)**

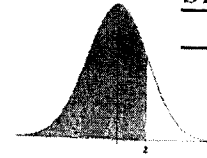
$$f_{X,Y}(x,y) = \frac{1}{8} (6 - x - y), \quad 0 \leq x \leq 2, \quad 2 \leq y \leq 4$$

1. Find $f_X(x)$
2. Find $f_Y(y)$
3. Find $P(2 \leq Y \leq 3)$
4. Find $P(X = 1)$
5. Find $P(1 \leq X \leq 2)$

End of questions.....

Good Luck
Dr. Basma Elkilany

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.



Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997



Course Title: **Database Systems** Course Code: **CCE 3112** **Third Year Students**
Date: **10-1-2023 (End-of-Semester Exam)** Time Allowed: **3 hour** No. of Pages: **(4)**

Answer the following questions.**Question 1(35 marks):**

1) Consider the following requirements list:

- Manufacturers have a name, which we may assume is unique, an address, and a phone number.
 - Products have a model number and a type (e.g., television set). Each product is made by one manufacturer, and different manufacturers may have different products with the same model number. However, you may assume that no manufacturer would have two products with the same model number.
 - Customers are identified by their unique social security number. They have email addresses, and physical addresses. Several customers may live at the same (physical) address, but we assume that no two customers have the same email address.
 - An order has a unique order number, and a date. An order is placed by one customer. For each order, there are one or more products ordered, and there is a quantity for each product on the order.
- a) Design an ER model to capture the above requirements. State any assumptions you have that affects your design. Make sure cardinalities and primary keys are clear.
- b) Convert this ER model to a relational schema diagram, showing the relations schemas and primary and foreign keys for each relation.

2) Consider a database with the following schema:

- STUDENT(SNO,SNAME,DEPT)
- ENROLL(CNO,SNO,GRADE)
- COURSE(CNO,DEPT)
- PREREQ(CNO,PNO)

Write relational algebra expressions for the following queries.

- a) Find the names of all the students enrolled in course CSE 562.
- b) Find the names, department and degree of all the students, who enrolled in course CSE531 or CSE562.
- c) For each student, find the course in which he obtained the highest degree.

Question 2 (35 marks):

1) Consider the following relations:

Student(snum: integer, sname: string, major: string, level: string, age: integer)

Class(name: string, meets at: string, room: string, fid: integer)

Enrolled(snum: integer, cname: string)

Faculty(fid: integer, fname: string, deptid: integer)

- Write the following queries in SQL. No duplicates should be printed in any of the answers.
- a) Find the names of all Juniors (level = JR) who are enrolled in a class taught by faculty name = I. Teach.
- b) Find the age of the oldest student who is either a History major or enrolled in a course taught by I. Teach.
- c) Find the names of all classes that either meet in room R128 or have five or more students enrolled.

2) Consider the following two transactions:

T1 : R(A), W(A), R(B), W(B), Commit

T2 : R(B), R(C), W(C), W(B), Commit

- Consider the following interleaved schedule of the two transactions:

RT1(A), RT2(B), RT2(C), WT1(A), RT1(B), WT1(B), WT2(C), WT2(B), CommitT1, CommitT2

Is the schedule serializable? If you claim yes, write an equivalent serial (non-interleaved) execution of the two transactions. If you claim no, explain why it is not serializable.

3) Consider a simple checkpointing protocol and the following set of operations in the log.

{(start, T4); (write, T4, y, 2, 3); (start, T1); (commit, T4); (write, T1, z, 5, 7); (checkpoint); (start, T2); (write, T2, x, 1, 9); (commit, T2); (start, T3); (write, T3, z, 7, 2)};

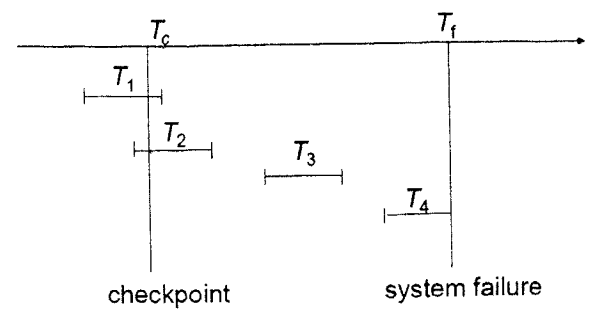
If a crash happens now and the system tries to recover using both undo and redo operations,

- a) what are the contents of the undo list and the redo list?
- b) What are the operations that will write in the log file during recovery process?

Question 3: Choose the correct answer:(Use the Electronic Sheet) (20 marks)

- 1) What is an Instance of a Database?
- a) The logical design of the database system
- b) The entire set of attributes of the Database put together in a single relation
- c) The state of the database system at any given point of time
- d) The initial values inserted into the Database immediately after its creation
- 2) Choose the correct statement regarding superkeys
- a) A superkey is an attribute or a group of multiple attributes that can uniquely identify a tuple
- b) A superkey is a tuple or a set of multiple tuples that can uniquely identify an attribute

- c) Every superkey is a candidate key
 - d) A superkey is an attribute or a set of attributes that distinguish the relation from other relations
- 3) Which of the following can replace the below query?
- ```
SELECT name, course_id
FROM instructor, teaches
WHERE instructor_ID= teaches_ID;
```
- a) SELECT name, course\_id FROM instructor natural join teaches ;
  - b) SELECT name, course\_id FROM instructor, teaches WHERE instructor\_ID= course\_ID;
  - c) SELECT name, course\_id FROM instructor;
  - d) None of These
- 4) Which of the following has "all-or-none" property?
- a) Atomicity    b) Durability    c) Isolation    d) All of the mentioned
- 5) \_\_\_\_\_ means that the data used during the execution of a transaction cannot be used by a second transaction until the first one is completed.
- a) Consistency    b) Atomicity    c) Durability    d) Isolation
- 6) The variables in the triggers are declared using
- a) -    b) @    c) /    d) /@
- 7) DML triggers in SQL Server is applicable to \_\_\_\_\_
- a) Insert    b) Update    c) Delete    d) All of the mentioned
- 8) Which statement(S) is/are incorrect
- a) Stored procedure can be shared by multiple programs
  - b) Stored procedures are in compiled form.
  - c) Stored procedure is a group of SQL statements
  - d) None of These.
- 9) What is a view?
- a) A view is a special stored procedure executed when certain event occurs
  - b) A view is a virtual table which results of executing a pre-compiled query
  - c) A view is a database diagram
  - d) None of the Mentioned
- 10) A system is in a \_\_\_\_\_ state if there exists a set of transactions such that every transaction in the set is waiting for another transaction in the set.
- a) Idle    b) Waiting    c) Deadlock    d) Ready



- 11) Consider the following execution diagram. To perform the recovery actions after system failure, what are the proper actions for transactions T1,T2,T3,T4.
- a) T1,T2 and T3 redone and T4 undone
  - b) T1 ignored,T2 and T3 undone and T4 redone

- c) T1 undone,T2 and T3 redone and T4 ignored
  - d) T1 ignored,T2 and T3 redone and T4 undone
- 12) What is a foreign key?
- a) A foreign key is a primary key of a relation which is an attribute in another relation
  - b) A foreign key is a superkey of a relation which is an attribute in more than one other relations
  - c) A foreign key is an attribute of a relation that is a primary key of another relation
  - d) A foreign key is the primary key of a relation that does not occur anywhere else in the schema
- 13) What is the method of specifying a primary key in a schema description?
- a) By writing it in bold letters
  - b) By underlining it using a dashed line
  - c) By writing it in capital letters
  - d) By underlining it using a bold line
- 14) In the relational modes, cardinality is termed as:
- a) Number of tuples.    b) Number of attributes.
  - c) Number of tables.    d) Number of constraints.
- 15) An advantage of the database management approach is
- a) data is dependent on programs.    b) data redundancy increases.
  - c) data is integrated and can be accessed by multiple programs.    d) none of the above.
- 16) The statement in SQL which allows to change the definition of a table is
- a) Alter.    b) Update.    c) Create.    d) select.
- 17) Which of the following operation is used if we are interested in only certain columns of a table?
- a) PROJECTION    b) SELECTION    c) UNION    d) JOIN
- 18) A table joined with itself is called
- a) Join    b) Self Join    c) Outer Join    d) Equi Join
- 19) The result of the UNION operation between R1 and R2 is a relation that includes
- a) all the tuples of R1    b) all the tuples of R2    c) all the tuples of R1 and R2
  - d) all the tuples of R1 and R2 which have common columns
- 20) Which of the following is a comparison operator in SQL?
- a) =    b) LIKE    c) BETWEEN    d) All of the above

**BEST WISHES**  
**Dr.Faten Elshwemy.**