

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) (FT/WP/PT) Examinations April 2026 (2019 Scheme)



Course Code: CST308

Course name: COMPREHENSIVE COURSE WORK

Max. Marks: 50

Duration: 1 Hour

- Instructions:**
- (1) Each question carries one mark. No negative marks for wrong answers
 - (2) Total number of questions: 50
 - (3) All questions are to be answered. Each question will be followed by 4 possible answers of which only ONE is correct.
 - (4) If more than one option is chosen, it will not be considered for valuation.

1. Consider a situation where a swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general?
a) Heap Sort b) Selection Sort c) Insertion Sort d) Merge Sort
2. Which of the following operations is not possible in a singly linked list?
a) Insertion at beginning b) Insertion at end c) Traversal in reverse direction d) Deletion at beginning
3. Using Insertion Sort, how many shifts are required to sort the elements 7, 3, 5, 2, 6 in ascending order?
a) 4 b) 5 c) 6 d) 7
4. Which data structure is most appropriate for checking whether parentheses in an expression are balanced?
a) Stack b) Queue c) Array d) Linked List
5. Evaluate the prefix expression: $- * + 10 \ 5 / 20 \ 4 \ 5$
a) 60 b) 65 c) 70 d) 75
6. The maximum number of nodes in a binary tree of height 4 (root at height 0) is:
a) 15 b) 16 c) 31 d) 32
7. Which traversal technique of a Binary Search Tree (BST) yields elements in ascending order?
a) Level Order b) Inorder c) Preorder d) Postorder
8. Which traversal is used to delete a tree safely?
a) Inorder b) Preorder c) Postorder d) Level order
9. Which graph traversal algorithm is used to find the shortest path in an unweighted graph?

- a) Depth First Search (DFS) b) Breadth First Search (BFS) c) Dijkstra's Algorithm d) Prim's Algorithm
10. State True or False
- i) A queue follows the LIFO principle.
ii) In a complete binary tree, all levels except possibly the last are completely filled.
- a) True, True b) True, False c) False, False d) False, True
11. Which synchronization mechanism is most appropriate to ensure mutual exclusion while accessing a critical section in a multithreaded program running on a multiprocessor system?
- a) Mutex b) Deadlock c) Semaphore d) Spooling
12. Which of the following is not an operating system?
- a) iOS b) Linux c) Oracle d) Unix
13. In a system using demand paging, what happens when a process accesses a page that is not currently in main memory?
- a) Context switch occurs immediately b) Page fault is generated c) Page is overwritten d) TLB is flushed
14. A disk has tracks numbered from 0 to 4999. The disk head is currently at track 1200. The previous request was at 1100, so the head is moving towards higher-numbered tracks. The pending request queue (in FIFO order) is: 1800, 900, 1300, 3000, 1000, 2500, 1400. Using the SCAN (Elevator) disk scheduling algorithm, the total head movement (in number of tracks) is _____.
- a) 7898 b) 8798 c) 7840 d) 7920
15. A system uses FIFO page replacement and has 3 page frames initially empty. The page reference string is: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3. The total number of page faults generated is _____.
- a) 9 b) 10 c) 11 d) 12
16. Which of the following techniques is used to handle deadlock?
- a) Deadlock avoidance b) Compaction c) Paging d) Swapping
17. In the Banker's algorithm, the system is in a safe state if:
- b) All resources are allocated b) Deadlock cannot occur c) There exists a safe sequence d) CPU utilization is maximum
18. Thrashing occurs when:
- a) CPU is idle b) Page fault rate is high c) Disk utilization is low d) Context switching is minimum
19. Which of the following is private to each thread within the same process?
- a) Address Space b) Global Variables c) Stack d) Global variables
20. Consider the code:
#include <stdio.h>


```
#include <unistd.h>
int x = 5;
int main() {
    fork();
    x = x + 5;
    printf("%d\n", x);
    return 0;
}
```

- a) 10 printed once b) 10 printed twice c) 15 printed once d) 15 printed twice
- 21 Which of the following memory types allows content-based access rather than address-based access?
a) RAM b) ROM c) Cache memory d) Associative memory
- 22 The basic unit of information in a computer is:
a) Bit b) Nibble c) Byte d) Word
- 23 In which addressing mode does the operand value form part of the instruction itself?
a) Immediate b) Register c) Direct d) Indirect
- 24 A cache has a hit ratio of 95%. Cache access time is 5 ns, and main memory access time is 80 ns. The average memory access time (AMAT) is:
a) 8.75 ns b) 9 ns c) 12 ns d) 80 ns
- 25 Which addressing mode is used when the effective address of the operand is obtained by adding a constant value to the contents of a register?
a) Immediate addressing b) Direct addressing c) Indexed addressing d) Indirect addressing
- 26 Which of the following correctly describes the CPU involvement during DMA transfer?
a) CPU transfers each word of data b) CPU polls the device continuously c) CPU initializes the DMA controller and is interrupted on completion d) CPU executes I/O instructions for every transfer
- 27 A system uses a direct-mapped cache with 4096 bytes cache size and 16-byte blocks. The number of index bits required is:
a) 6 b) 7 c) 8 d) None of these
- 28 Which of the following is the fundamental building block used to design an arithmetic logic unit (ALU)?
a) Half adder b) Full adder c) Decoder d) Multiplexer
- 29 Which of the following cannot be eliminated using instruction pipelining?
a) Structural hazards b) Data hazards c) Control hazards d) All of these
- 30 Compared to RISC processors, CISC processors contain _____.
a) More transistor elements b) Larger instruction set and fewer registers c) More registers and smaller instruction set d) Both (a) and (b)

- 31 Which of the following SQL command(s) belong to the Data Manipulation Language (DML) category?
1. TRUNCATE
 2. UPDATE
 3. DELETE
 4. DROP
- a) 1 and 2 only b) 2 and 3 only c) 1, 2 and 3 only d) 1, 3 and 4 only
- 32 Consider an E-R diagram with the following characteristics:
- Entity A is a strong entity with a primary key.
 - Entity B is a weak entity that depends on A for identification.
 - The relationship between A and B is an identifying one-to-many relationship.
 - Neither A, B, nor the relationship has any additional attributes.
 - All attributes are simple and single-valued.
- What is the minimum number of relations (tables) required to represent this design in the relational model?
- a) 2 b) 3 c) 4 d) 5
- 33 Consider the relation $R(P, Q, R, S)$ with the set of functional dependencies $F = \{P \rightarrow Q, Q \rightarrow R, R \rightarrow S\}$
- What is the highest normal form of the relation?
- a) 1NF b) 2NF c) 3NF d) BCNF
- 34 Which of the following statements is always true?
- a) Every 3NF relation is in BCNF b) Every BCNF relation is in 3NF c) Every 2NF relation is in 3NF d) Every 1NF relation is in 2NF
- 35 What is the meaning of the following SQL query?
- SELECT name FROM student WHERE name LIKE 'a%';
- a) List of student names that start with "a" b) List of student names whose second character is 'a' c) List of student names that contain the substring "a" anywhere d) None of these
- 36 Which of the following SQL statements will change the structure of a table and cannot be rolled back once executed?
1. TRUNCATE TABLE Student;
 2. DELETE FROM Student;
 3. DROP TABLE Student;
 4. ALTER TABLE Student ADD age INT;
- a) 1 and 4 only b) 3 only c) 1, 3 and 4 only d) 2 and 4 only
- 37 A B-tree of order 4 is used to store integer keys.
- Which of the following statements is/are TRUE?
1. Each internal node can have at most 4 children
 2. Each node can store at most 3 keys
 3. Data records (keys) may be stored in both internal and leaf nodes
 4. Leaf nodes are necessarily linked to support sequential access

- a) 1, 2 and 3 only b) 2, 3 and 4 only c) All of these d) None of these
- 38 Consider the following two transactions with data items X and Y, both initialized to 0:
 T1:
 read(X);
 read(Y);
 if X = 0 then Y := Y + 2;
 write(Y);
 T2:
 read(Y);
 read(X);
 if Y = 0 then X := X + 2;
 write(X);
 Any non-serial interleaving of T1 and T2 during concurrent execution results in:
 a) A serializable schedule b) A schedule that is not conflict-serializable c) A conflict-serializable schedule d) A schedule with no conflicting operations
- 39 Which of the following statements about database triggers is/are TRUE?
 1. A trigger is automatically executed when a specified event occurs on a table
 2. A trigger can be activated by INSERT, UPDATE, or DELETE operations
 3. A trigger must be explicitly called using a SQL statement
 4. A trigger can be defined before or after a database event
 a) 1, 2 and 4 only b) 2 and 4 only c) 1, 2 and 3 only d) All of these
- 40 Which of the following statements about the Two-Phase Locking (2PL) protocol is/are TRUE?
 1. A transaction must acquire all locks before releasing any lock
 2. 2PL guarantees conflict serializability
 3. 2PL can lead to deadlock
 4. 2PL guarantees freedom from starvation
 a) 2 and 3 only b) 1, 2 and 3 only c) 2, 3 and 4 only d) All of these
- 41 Which of the following computational models is *specifically used to recognize regular languages*?
 a) Turing machine. b) Pushdown automaton. c) Linear-bounded automaton d) Finite automaton.
- 42 Consider the grammar $G = (V, T, P, S)$ with the following productions:
 $S \rightarrow aSb \mid ab$
 $A \rightarrow aA \mid a$
 The above grammar is:
 a) Regular b) Context Free c) Context Sensitive d) Type-0
- 43 Which of the following languages cannot be generated by a regular grammar?
 a) The set of all binary strings that end with 1 b) The set of all strings over $\{a, b\}$ containing an even number of a's c) The set of all strings of the form $a^m b^n$, where $m, n \geq 0$ d) The set of all strings of the form $a^n b^n$, where $n \geq 1$
- 44 Which of the following model conversions does NOT have a general algorithm to produce an equivalent deterministic model?

- a) Right-linear grammar $\rightarrow$ Finite automaton b) Nondeterministic finite automaton $\rightarrow$ Deterministic finite automaton c) Nondeterministic pushdown automaton $\rightarrow$ Deterministic pushdown automaton d) Nondeterministic Turing machine $\rightarrow$ Deterministic Turing machine
- 45 Consider the grammar $G = (\{S\}, \{a, b\}, P, S)$ with productions: $S \rightarrow aSb \mid ab$ Which of the following languages is generated by the grammar G ?
 a) $\{a^n b^n \mid n \geq 0\}$ b) $\{a^n b^n \mid n \geq 1\}$ c) $\{a^n b^m \mid n, m \geq 1\}$ d) $\{a^n b^{n+1} \mid n \geq 1\}$
- 46 Subset Construction method refers to:
 a) Conversion of NFA to DFA b) DFA minimization c) Eliminating Null references d) ϵ -NFA to NFA
- 47 Which automaton allows multiple transitions for the same input symbol from a state?
 a) DFA b) Moore Machine c) NFA d) Mealy Machine
- 48 Which of the following problems is undecidable?
 a) Whether a DFA accepts at least one string b) Whether two DFAs accept the same language c) Whether a string belongs to a given context-free language d) Whether a Turing machine halts on a given input
- 49 A context-free grammar is said to be ambiguous if:
 a) It contains more than one production for a non-terminal b) There exists a string in the language with multiple parse trees c) Contains left recursion d) It can generate the empty string
- 50 Which of the following operations is NOT guaranteed to preserve regularity of a language?
 a) Inverse Homomorphism b) Intersection c) Kleene star d) None of these
