

MIZORAM PUBLIC SERVICE COMMISSION

GENERAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF PROGRAMMER UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT, JULY, 2018

TECHNICAL PAPER - I

Time Allowed : 2 hours

Full Marks : 200

All questions carry equal marks of 2 each.

Attempt all questions.

1. What are the disadvantages of arrays?
 - (a) We must know before hand how many elements will be there in the array
 - (b) There are chances of wastage of memory space if elements inserted in an array are lesser than the allocated size
 - (c) Insertion and deletion becomes tedious
 - (d) All of the mentioned
2. Consider the usual algorithm for determining whether a sequence of parentheses is balanced. The maximum number of parentheses that appear on the stack *at any one time* when the algorithm analyzes: $((()())())$ are:
 - (a) 1
 - (b) 2
 - (c) 3
 - (d) 4 or more
3. Which data structure is used for implementing recursion?
 - (a) Queue
 - (b) Stack
 - (c) Array
 - (d) List
4. A data structure in which elements can be inserted or deleted at/from both the ends but not in the middle is?
 - (a) Queue
 - (b) Circular queue
 - (c) Dequeue
 - (d) Priority queue
5. A normal queue, if implemented using an array of size MAX_SIZE, gets full when
 - (a) $\text{Rear} = \text{MAX_SIZE} - 1$
 - (b) $\text{Front} = (\text{rear} + 1) \bmod \text{MAX_SIZE}$
 - (c) $\text{Front} = \text{rear} + 1$
 - (d) $\text{Rear} = \text{front}$
6. What would be the asymptotic time complexity to insert an element at the second position in the linked list?
 - (a) $O(1)$
 - (b) $O(2)$
 - (c) $O(n)$
 - (d) $O(n^2)$
7. Linked list is considered as an example of _____ type of memory allocation.
 - (a) Dynamic
 - (b) Static
 - (c) Compile time
 - (d) Run Time

8. You are given pointers to first and last nodes of a singly linked list, which of the following operations are dependent on the length of the linked list?
- (a) Delete the first element (b) Insert a new element as a first element
(c) Delete the last element of the list (d) Add a new element at the end of the list
9. What is a memory efficient double linked list?
- (a) Each node has only one pointer to traverse the list back and forth
(b) The list has breakpoints for faster traversal
(c) An auxiliary singly linked list acts as a helper list to traverse through the doubly linked list
(d) None of the mentioned
10. Disadvantage of using array representation for binary trees is?
- (a) difficulty in knowing children nodes of a node
(b) difficult in finding the parent of a node
(c) have to know the maximum number of nodes possible before creation of trees
(d) difficult to implement
11. In a binary search tree, which of the following traversals would print the numbers in the ascending order?
- (a) Level-order traversal (b) Pre-order traversal
(c) Post-order traversal (d) In-order traversal
12. What is a complete binary tree?
- (a) Each node has exactly zero or two children
(b) A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from right to left
(c) A binary tree, which is completely filled, with the possible exception of the bottom level, which is filled from left to right
(d) None of the mentioned
13. What is the average case complexity of bubble sort?
- (a) $O(n \log n)$ (b) $O(\log n)$
(c) $O(n)$ (d) $O(n^2)$
14. In a max-heap, element with the greatest key is always in which node?
- (a) Leaf node (b) First node of left sub tree
(c) Root node (d) First node of right sub tree
15. The Data structure used in standard implementation of Breadth First Search is?
- (a) Stack (b) Queue
(c) Linked List (d) None of the mentioned
16. In dynamic programming, the technique of storing the previously calculated values is called
- (a) Saving value property (b) Storing value property
(c) Memoization (d) Mapping
17. Which of the following problems should be solved using dynamic programming?
- (a) Mergesort (b) Binary search
(c) Longest common subsequence (d) Quicksort

18. If a problem can be solved by combining optimal solutions to non-overlapping problems, the strategy is called _____
- (a) Dynamic programming (b) Greedy
(c) Divide and conquer (d) Recursion
19. Which of the following sorting algorithms in its typical implementation gives best performance when applied on an array which is sorted or almost sorted (maximum 1 or two elements are misplaced).
- (a) Quick Sort (b) Heap Sort
(c) Merge Sort (d) Insertion Sort
20. Depth First Search is equivalent to which of the traversal in the Binary Trees?
- (a) Pre-order Traversal (b) Post-order Traversal
(c) Level-order Traversal (d) In-order Traversal
21. Time Complexity of DFS is? (V – number of vertices, E – number of edges)
- (a) $O(V + E)$ (b) $O(V)$
(c) $O(E)$ (d) $O(V * E)$
22. The PreOrder and PostOrder traversal of binary tree generate the same out put. The tree can have maximum
- (a) One node (b) Two node
(c) Three node (d) Any number of node
23. In a stack, if a user tries to remove an element from empty stack it is called _____
- (a) Underflow (b) Empty collection
(c) Overflow (d) Garbage Collection
24. The postfix form of $A * B + C / D$ is?
- (a) $*AB/CD+$ (b) $AB*CD/+$
(c) $A*BC+/D$ (d) $ABCD+/*$
25. The result of evaluating the postfix expression 5, 4, 6, +, *, 4, 9, 3, /, +, * is?
- (a) 600 (b) 350
(c) 650 (d) 588
26. If we choose Prim's Algorithm for uniquely weighted spanning tree instead of Kruskal's Algorithm, then
- (a) we'll get a different spanning tree. (b) we'll get the same spanning tree.
(c) spanning will have less edges. (d) spanning will not cover all vertices.
27. If a node having two children is deleted from a binary tree, it is replaced by its
- (a) Preorder predecessor (b) Inorder predecessor
(c) Inorder Successor (d) Preorder Successor
28. The quick sort algorithm exploit _____ design technique
- (a) Back tracking (b) Dynamic Programming
(c) Divide and Conquer (d) Overflow

29. The memory address of fifth element of an array can be calculated by the formula
- (a) $LOC(\text{Array}[5]) = \text{Base}(\text{Array}) + w(5 - \text{lower bound})$, where w is the number of words per memory cell for the array
 - (b) $LOC(\text{Array}[5]) = \text{Base}(\text{Array}[5]) + (5w - \text{lower bound})$, where w is the number of words per memory cell for the array
 - (c) $LOC(\text{Array}[5]) = \text{Base}(\text{Array}[4w]) + (5 - \text{Upper bound})$, where w is the number of words per memory cell for the array
 - (d) None of above
30. Data Structure: Preorder and in order of a tree is given as
Preorder : A B D H E C F I G J K
Inorder : D H B E A I F C J G K
- What will be the postorder?
- (a) H D E B I F J K G C A
 - (b) H D E B F I J K G C A
 - (c) H D E B I F J K C G A
 - (d) H D E B F I J K C G A
31. If a binary tree has height 10 then what is the maximum number of nodes in that tree?
- (a) 1000
 - (b) 1023
 - (c) 1024
 - (d) 1002
32. _____ comparisons required to sort the list 1, 2, 3, ..., n using insertion sort.
- (a) $(n^2 + n + 2) / 2$
 - (b) $(n^3 + n - 2) / 2$
 - (c) $(n^2 + n - 2) / 2$
 - (d) $(n^2 - n - 2) / 2$
33. List obtained in third pass of selection sort for list 3, 5, 4, 1, 2 is _____
- (a) 1,2,4,3,5
 - (b) 1,2,3,4,5
 - (c) 1,5,4,3,2
 - (d) 3,5,4,1,2
34. Consider the following functions: $f(n) = 2^n$, $g(n) = n!$, $h(n) = n^{\log n}$
Which of the following Statement about the asymptotic behavior of $f(n)$, $g(n)$ and $h(n)$ is true?
- (a) $f(n) = O(g(n)); g(n) = O(h(n))$
 - (b) $f(n) = \Omega(g(n)); g(n) = O(h(n))$
 - (c) $g(n) = O(f(n)); h(n) = O(f(n))$
 - (d) $h(n) = O(f(n)); g(n) = \Omega(f(n))$
35. Which memory device is generally made of semi-conductors?
- (a) RAM
 - (b) Hard-disk
 - (c) Floppy disk
 - (d) Compact disk
36. The ALU makes use of _____ to store the intermediate results.
- (a) Accumulators
 - (b) Registers
 - (c) Heap
 - (d) Stack
37. The control unit controls other units by generating _____
- (a) Control signals
 - (b) Timing signals
 - (c) Transfer signals
 - (d) Command Signals
38. The Input devices can send information to the processor.
- (a) When the SIN status flag is set
 - (b) When the data arrives regardless of the SIN flag
 - (c) Neither of the cases
 - (d) Either of the cases

39. The I/O interface required to connect the I/O device to the bus consists of _____
- (a) Address decoder and registers
 - (b) Control circuits
 - (c) Address decoder, registers and Control circuits
 - (d) Only Control circuits
40. _____ is generally used to increase the apparent size of physical memory.
- (a) Secondary memory
 - (b) Virtual memory
 - (c) Hard-disk
 - (d) Disks
41. The time delay between two successive initiation of memory operation _____
- (a) Memory access time
 - (b) Memory search time
 - (c) Memory cycle time
 - (d) Instruction delay
42. The decoded instruction is stored in _____
- (a) IR
 - (b) PC
 - (c) Registers
 - (d) MDR
43. Which of the register/s of the processor is/are connected to Memory Bus ?
- (a) PC
 - (b) MAR
 - (c) IR
 - (d) Both PC and MAR
44. A processor performing fetch or decoding of different instruction during the execution of another instruction is called _____
- (a) Super-scaling
 - (b) Pipe-lining
 - (c) Parallel Computation
 - (d) None of the mentioned
45. The two phases of executing an instruction are _____
- (a) Instruction decoding and storage
 - (b) Instruction fetch and instruction execution
 - (c) Instruction execution and storage
 - (d) Instruction fetch and Instruction processing
46. When 1101 is used to divide 100010010 the remainder is _____
- (a) 101
 - (b) 11
 - (c) 0
 - (d) 1
47. In memory-mapped I/O _____
- (a) The I/O devices and the memory share the same address space
 - (b) The I/O devices have a separate address space
 - (c) The memory and I/O devices have an associated address space
 - (d) A part of the memory is specifically set aside for the I/O operation
48. The method of accessing the I/O devices by repeatedly checking the status flags is
- (a) Program-controlled I/O
 - (b) Busy Waiting I/O
 - (c) I/O mapped
 - (d) DMA
49. The signal sent to the device from the processor to the device after receiving an interrupt is
- (a) Interrupt-acknowledge
 - (b) Return signal
 - (c) Service signal
 - (d) Permission signal

50. Which interrupt is non maskable?
(a) RST 5.5 (b) RST 7.5
(c) TRAP (d) Both RST 5.5 and 7.5
51. The disadvantage of DRAM over SRAM is/are _____
(a) Lower data storage capacities (b) Higher heat dissipation
(c) The cells are not static (d) All of the mentioned
52. The contents of the EPROM are erased by _____
(a) Overcharging the chip (b) Exposing the chip to UV rays
(c) Exposing the chip to IR rays (d) Discharging the Chip
53. The product of -13 and 11 is
(a) 1100110011 (b) 1101110001
(c) 1010101010 (d) 1111111000
54. If $(101.01)_2 = (x)_{10}$, then what is the value of x?
(a) 505.05 (b) 10.101
(c) 101.01 (d) 5.25
55. The decimal number 10 is represented in its BCD form as
(a) 1010 (b) 01010
(c) 00010000 (d) 001010
56. It should be kept in mind that don't care terms should be used along with the terms that are present in
(a) Minterms (b) Maxterm
(c) K-Map (d) Latches
57. Boolean expression $A(A + B)$ is equivalent to _____
(a) AB (b) 1
(c) $(1 + AB)$ (d) A
58. The NOR gate output will be high if the two inputs are
(a) 00 (b) 01
(c) 10 (d) 11
59. How many AND gates are required to realize $Y = CD + EF + G$?
(a) 4 (b) 5
(c) 3 (d) 2
60. If A and B are the inputs of a half adder, the sum is given by
(a) A AND B (b) A OR B
(c) A XOR B (d) A NOT B
61. The difference between half adder and full adder is
(a) Half adder has two inputs while full adder has four inputs
(b) Half adder has one output while full adder has two outputs
(c) Half adder has two inputs while full adder has three inputs
(d) All of the Mentioned

62. Registers capable of shifting in one direction is
- (a) Universal shift register
 - (b) Unidirectional shift register
 - (c) Unipolar shift register
 - (d) Unique shift register
63. For a Counter having a count range 0000_2 to 1010_2 , the required number of flip flop is:
- (a) 2
 - (b) 3
 - (c) 4
 - (d) 5
64. If 'n' denotes number of clock cycles and 'T' denotes period of the clock at which the microprocessor is running, then duration of execution of loop once can be denoted by
- (a) $n+T$
 - (b) $n-T$
 - (c) $n*T$
 - (d) n/T
65. To access the services of operating system, the interface is provided by the
- (a) System calls
 - (b) API
 - (c) Library
 - (d) Assembly instructions
66. Process is
- (a) program in High level language kept on disk
 - (b) contents of main memory
 - (c) a program in execution
 - (d) a job in secondary memory
67. What is the ready state of a process?
- (a) when process is scheduled to run after some execution
 - (b) when process is unable to run until some task has been completed
 - (c) when process is using the CPU
 - (d) when process is waiting for I/O operation
68. A set of processes is deadlock if
- (a) each process is blocked and will remain so forever
 - (b) each process is terminated
 - (c) all processes are trying to kill each other
 - (d) all processes are block for short interval time.
69. A Process Control Block(PCB) does not contain which of the following :
- (a) Code
 - (b) Stack
 - (c) Bootstrap program
 - (d) Data
70. The number of processes completed per unit time is known as _____
- (a) Output
 - (b) Throughput
 - (c) Efficiency
 - (d) Capacity
71. The entry of all the PCBs of the current processes is in:
- (a) Process Register
 - (b) Program Counter
 - (c) Process Table
 - (d) Process Unit
72. The objective of multi-programming is to :
- (a) Have some process running at all times
 - (b) Have multiple programs running at the same time.
 - (c) To minimize CPU utilization
 - (d) To decrease data transfer

73. What is a long-term scheduler ?
- (a) It selects which process has to be brought into the ready queue
 - (b) It selects which process has to be executed next and allocates CPU
 - (c) It selects which process to remove from memory by swapping
 - (d) It selects which process will use CPU for longest period
74. In a time-sharing operating system, when the time slot given to a process is completed, the process goes from the running state to the :
- (a) Blocked state
 - (b) Ready state
 - (c) Suspended state
 - (d) Terminated state
75. The LRU algorithm
- (a) pages out pages that have been used recently
 - (b) pages out pages that have not been used recently
 - (c) pages out pages that have been least used recently
 - (d) pages out the first page in a given area
76. An interrupt vector
- (a) is an address that is indexed to an interrupt handler
 - (b) is a unique device number that is indexed by an address
 - (c) is a unique identity given to an interrupt
 - (d) none of the mentioned
77. Process are classified into different groups in
- (a) shortest job scheduling algorithm
 - (b) round robin scheduling algorithm
 - (c) priority scheduling algorithm
 - (d) multilevel queue scheduling algorithm
78. The processes that are residing in main memory and are ready and waiting to execute are kept on a list called
- (a) job queue
 - (b) ready queue
 - (c) execution queue
 - (d) process queue
79. 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
80. Consider the following set of processes, the length of the CPU burst time given in milliseconds:
- | <u>Processes</u> | <u>Burst Time</u> | <u>Arrival time</u> |
|------------------|-------------------|---------------------|
| P1 | 6 | 0 |
| P2 | 8 | 0 |
| P3 | 7 | 0 |
| P4 | 3 | 0 |
- Assuming the above process being scheduled with the SJF scheduling algorithm, what is the waiting time for process P1?
- (a) 3ms
 - (b) 0ms
 - (c) 16ms
 - (d) 9ms
81. A solution to the problem of indefinite blockage of low priority processes is :
- (a) Starvation
 - (b) Wait queue
 - (c) Ready queue
 - (d) Aging

82. A situation where several processes access and manipulate the same data concurrently and the outcome of the execution depends on the particular order in which access takes place is called :
- (a) data consistency
 - (b) race condition
 - (c) degree of concurrency
 - (d) concurrent ordering
83. The segment of code in which the process may change common variables, update tables, write into files is known as :
- (a) critical program
 - (b) critical section
 - (c) critical code
 - (d) synchronizing section
84. The two atomic operations permissible on semaphores are :
- (a) wait and Signal
 - (b) stop and Run
 - (c) hold and Release
 - (d) exception and throw
85. At a particular time of computation the value of a counting semaphore is 7. Then 20 P operations and 15 V operations were completed on this semaphore. The resulting value of the semaphore is :
- (a) 42
 - (b) 2
 - (c) 7
 - (d) 12
86. Which of the following condition is required for deadlock to be possible?
- (a) mutual exclusion
 - (b) a process may hold allocated resources while awaiting assignment of other resources
 - (c) no resource can be forcibly removed from a process holding it
 - (d) all of the mentioned
87. Which one of the following is a visual (mathematical) way to determine the deadlock occurrence?
- (a) resource allocation graph
 - (b) starvation graph
 - (c) inversion graph
 - (d) chaining graph
88. The address generated by the CPU is referred to as :
- (a) Physical address
 - (b) Logical address
 - (c) Temporary Address
 - (d) Dynamic address
89. Memory management technique in which system stores and retrieves data from secondary storage for use in main memory is called
- (a) fragmentation
 - (b) paging
 - (c) mapping
 - (d) spooling
90. What is compaction?
- (a) a technique for overcoming internal fragmentation
 - (b) a paging technique
 - (c) a technique for overcoming external fragmentation
 - (d) a technique for overcoming fatal error
91. In contiguous memory allocation :
- (a) each process is contained in a single contiguous section of memory
 - (b) all processes are contained in a single contiguous section of memory
 - (c) the memory space is contiguous
 - (d) the address space of processes are contiguous

92. If the size of logical address space is 2 to the power of m, and a page size is 2 to the power of n addressing units, then the high order _____ bits of a logical address designate the page number, and the _____ low order bits designate the page offset.
- (a) m, n (b) n, m
(c) m – n, m (d) m – n, n
93. The segment limit contains the :
- (a) starting logical address of the process
(b) starting physical address of the segment in memory
(c) segment length
(d) segment Number
94. When device A has a cable that plugs into device B, and device B has a cable that plugs into device C and device C plugs into a port on the computer, this arrangement is called a _____
- (a) port (b) daisy chain
(c) bus (d) cable
95. The CPU hardware has a wire called _____ that the CPU senses after executing every instruction.
- (a) interrupt request line (b) interrupt bus
(c) interrupt receive line (d) interrupt sense line
96. A _____ is a collection of electronics that can operate a port, a bus, or a device.
- (a) controller (b) driver
(c) host (d) bus
97. _____ is a unique tag, usually a number, identifies the file within the file system.
- (a) File identifier (b) File name
(c) File type (d) File Number
98. The disadvantage of the two level directory structure is that :
- (a) it does not solve the name collision problem
(b) it solves the name collision problem
(c) it does not isolate users from one another
(d) it isolates users from one another
99. For a direct access file :
- (a) there are restrictions on the order of reading and writing
(b) there are no restrictions on the order of reading and writing
(c) access is restricted permission wise
(d) access is not restricted permission wise
100. The worse case in quicksort algorithm occurs when :
- (a) Each level of the tree has only a single node.
(b) Each level of the tree has two more nodes than the previous level.
(c) Each level of the tree has one more nodes than the previous level.
(d) None of the above.