**Multiple Choice Questions**

Choose the correct option for following questions. All the Questions carry equal marks

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>_______ classified the computers on the basis of organization of the constituent elements in the computer.</td>
</tr>
<tr>
<td>Option A:</td>
<td>Flynn</td>
</tr>
<tr>
<td>Option B:</td>
<td>Handler</td>
</tr>
<tr>
<td>Option C:</td>
<td>Shore</td>
</tr>
<tr>
<td>Option D:</td>
<td>Feng</td>
</tr>
</tbody>
</table>

| 2. | Two stage instruction pipeline has |
| Option A: | fetch and Execute instruction |
| Option B: | Fetch and Write Instruction |
| Option C: | Fetch and Decode |
| Option D: | Fetch and Memory Excess |

| 3. | In 3-D hypercube network topology the neighbor of node zero are |
| Option A: | node 1 and node 2 and node 4 |
| Option B: | node 2 and node 3 and node 4 |
| Option C: | node 3 and node 1 and node 4 |
| Option D: | node 1 and node 4 and node 3 |

| 4. | The length of the longest path in a task dependency graph is called |
| Option A: | the critical path length |
| Option B: | the critical data length |
| Option C: | the critical bit length |
| Option D: | the critical byte length |

| 5. | _______ suited to problems that are solved using the divide-and-conquer strategy |
| Option A: | exploratory decomposition |
| Option B: | Recursive Decomposition |
| Option C: | speculative decomposition |
| Option D: | data decomposition |

| 6. | Using fewer than the maximum possible number of processing elements to execute a parallel algorithm is called ______ a parallel system in terms of the number of processing elements. |
| Option A: | Scaling down |
| Option B: | Scaling up |
| Option C: | Cost optimal |
### Question 7
Which speedup could be achieved according to Amdahl’s law for infinite number of processors if 5% of a program is sequential and the remaining part is ideally parallel?

<table>
<thead>
<tr>
<th>Option A</th>
<th>Infinite speedup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>5</td>
</tr>
<tr>
<td>Option C</td>
<td>50</td>
</tr>
<tr>
<td>Option D</td>
<td>20</td>
</tr>
</tbody>
</table>

### Question 8
Parallelism can be used to increase the (parallel) size of the problem is applicable in

<table>
<thead>
<tr>
<th>Option A</th>
<th>Amdahl's Law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>Gustafson-Barsis's Law</td>
</tr>
<tr>
<td>Option C</td>
<td>Newton's Law</td>
</tr>
<tr>
<td>Option D</td>
<td>Pascal's Law</td>
</tr>
</tbody>
</table>

### Question 9
The Prefix Sum Operation can be implemented using the______

<table>
<thead>
<tr>
<th>Option A</th>
<th>All-to-all broadcast kernel.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>All-to-one broadcast kernel.</td>
</tr>
<tr>
<td>Option C</td>
<td>One-to-all broadcast Kernel</td>
</tr>
<tr>
<td>Option D</td>
<td>Scatter Kernel</td>
</tr>
</tbody>
</table>

### Question 10
The _______ functions are used to determine the number of processes

<table>
<thead>
<tr>
<th>Option A</th>
<th>MPI_Init</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>MPI_Comm_world</td>
</tr>
<tr>
<td>Option C</td>
<td>MPI_Comm_size</td>
</tr>
<tr>
<td>Option D</td>
<td>MPI_Comm_rank</td>
</tr>
</tbody>
</table>

### Question 11
Handler's classification uses the following three pairs of integers to describe a computer: Computer = (p * p', a * a', b * b')

So here what is a meaning of P’

<table>
<thead>
<tr>
<th>Option A</th>
<th>Number of PCUs that can be pipelined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>Number of bits that can be pipelined</td>
</tr>
<tr>
<td>Option C</td>
<td>Number of segments can be pipelined</td>
</tr>
<tr>
<td>Option D</td>
<td>Number of bytes that can be pipelined</td>
</tr>
</tbody>
</table>

### Question 12
Control hazards occurs due to______

<table>
<thead>
<tr>
<th>Option A</th>
<th>ADD instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>MUL instruction</td>
</tr>
<tr>
<td>Option C</td>
<td>DIV instruction</td>
</tr>
<tr>
<td>Option D</td>
<td>Branch instruction</td>
</tr>
</tbody>
</table>

### Question 13
Messages in Cut through routing are divided into?

<table>
<thead>
<tr>
<th>Option A</th>
<th>Packets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option B</td>
<td>Segments</td>
</tr>
<tr>
<td>Option C</td>
<td>Flits</td>
</tr>
<tr>
<td>Option D</td>
<td>smaller units</td>
</tr>
</tbody>
</table>
14. We anticipate which pages we are going to browse ahead of time and issue requests for them in advance is known as _______________.
   Option A: Prefetching
   Option B: Multithreading
   Option C: Multitasking
   Option D: Latency

15. The number and size of tasks into which a problem is decomposed determines the_________ of the decomposition.
   Option A: Concurrency
   Option B: Task dependency
   Option C: Granularity
   Option D: Efficiency

16. __________ is due to load imbalance, synchronization, or serial components as parts of overheads in parallel programs.
   Option A: Inter process interaction
   Option B: Synchronization
   Option C: Idling
   Option D: Excess computation

17. Which speedup could be achieved according to Amdahl’s law for infinite number of processors if 5% of a program is sequential and the remaining part is ideally parallel?
   Option A: Infinite speedup
   Option B: 5
   Option C: 50
   Option D: 20

18. Parallelism can be used to increase the (parallel) size of the problem is applicable in ________________.
   Option A: Amdahl's Law
   Option B: Gustafson-Barsis's Law
   Option C: Newton's Law
   Option D: Pascal's Law

19. Synchronization is one of the common issues in parallel programming. The issues related to synchronization include the followings, EXCEPT:
   Option A: Deadlock
   Option B: Livelock
   Option C: Fairness
   Option D: Correctness

20. Which MPI function is used to determine the label of calling process?
   Option A: MPI_Init
   Option B: MPI_Comm_world
   Option C: MPI_Comm_size
   Option D: MPI_Comm_rank
21. Due to architectural arrangement of a single instruction stream with multiple data streams, array processors machines are called ______ array processor.
   Option A: MISD
   Option B: SIMD
   Option C: SISD
   Option D: MIMD

22. SIMD computers require less memory because only ________ needs to be stored.
   Option A: one copy of the program
   Option B: one instruction of the program
   Option C: two instruction of the program
   Option D: few instruction of the program

23. A processor without structural Hazards is ____________.
   Option A: Faster
   Option B: Stock
   Option C: Deadlock
   Option D: Structural hazard

24. Control hazards occurs due to______
   Option A: ADD instruction
   Option B: MUL instruction
   Option C: DIV instruction
   Option D: Branch instruction

25. Pipeline increases the CPU instruction____________.
   Option A: Size
   Option B: Through put
   Option C: Cycle rate
   Option D: Time

26. If during a cycle, no functional units are utilized, this is referred to as ______ waste
   Option A: Horizontal waste
   Option B: Vertical waste
   Option C: Data waste
   Option D: Explicitly waste

27. If the second instruction cannot be issued because it has a data dependency with the first, only one instruction is issued in the cycle. This is called________ issue.
   Option A: In-order
   Option B: Out-order
   Option C: Execution
   Option D: Data

28. Since it uses the out of order mode of execution, the results are stored in ______
   Option A: Buffers
| Option B: | Special memory locations |
| Option C: | Temporary registers |
| Option D: | TLB |

29. If an exception is raised and the succeeding instructions are executed completely, then the processor is said to have ______

Option A: Exception handling
Option B: Imprecise exceptions
Option C: Error correction
Option D: Exception

30. The pattern of___________ among tasks is captured by what is known as a task-interaction graph

Option A: Interaction
Option B: Communication
Option C: Optimization
Option D: Flow

31. _______ mapping techniques distribute the work among processes during the execution of the algorithm.

Option A: Static
Option B: Sequential
Option C: Uniform
Option D: Dynamic

32. _______ is a method for inducing concurrency in problems that can be solved using the divide-and-conquer strategy.

Option A: exploratory decomposition
Option B: speculative decomposition
Option C: data-decomposition
Option D: Recursive decomposition

33. A decomposition into a large number of small tasks is called _________.

Option A: coarse-grained
Option B: coarse-ungrained
Option C: fine-grained
Option D: fine-ungrained

34. The number of processors used to execute a program is defined as the _______ of parallelism.

Option A: Degree
Option B: Level
Option C: Amount
Option D: Rank

35. Speed up is defined as a ratio of

Option A: S=Ts/Tp
**Option B:** \( S = \frac{T_p}{T_s} \)
**Option C:** \( T_s = \frac{S}{T_p} \)
**Option D:** \( T_p = \frac{S}{T_s} \)

36. **Option A:** Total Cost = Time complexity \( \times \) Number of processors used
**Option B:** Total Cost = Time complexity \( \times \) Number of cycle used
**Option C:** Total Cost = Time complexity \( \times \) Number of task used
**Option D:** Total Cost = Time complexity \( \times \) Number of instructions used

37. **Option A:** Higher Dimensional topology
**Option B:** Cartesian topologies
**Option C:** Cart topologies
**Option D:** Ring topologies

38. **Option A:** buffered Receive may perform better than buffered sends
**Option B:** buffered Receive may perform better than non-buffered sends
**Option C:** buffered sends may perform better than non-buffered sends
**Option D:** non-buffered sends may perform better than buffered sends

39. **Option A:** MPI_Bcast function
**Option B:** MPI_Broadcast function
**Option C:** MPI_BroadCast function
**Option D:** MPI_BCast function

40. **Option A:** Send Buffer
**Option B:** Buffer
**Option C:** check-status
**Option D:** Receive Buffer

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**Descriptive Questions**

Explain Decomposition techniques.

Write MPI program for Cannon’s Matrix-Matrix Multiplication.

Explain different performance metrics for Parallel System.

Explain Non-Blocking Communication using MPI.

Explain sources of overhead in parallel programs.

Describe pipeline performance (Efficiency, Speedup and Throughput) w.r.t length of the pipe \( n \) and task run on pipe \( m \) for condition \( m \gg n, n \gg m \) and \( m = n \).

Write a MPI program to find sum of \( N \) numbers.

Explain speedup, efficiency and scalability with suitable example.
Short note on 'SIMD matrix multiplication'.

State and explain Amdahl’s law. What is the relevance of Amdahl’s law in HPC?

Discuss different levels of parallel processing?

With neat block diagram explain in detail about the various programmatic levels of parallel processing.

Explain the different mapping techniques that are used load balancing.

Discuss in detail Pipeline hazards with its types.

Explain Very long instruction word (VLIW) in detail.

Write a parallel MPI program to broadcast a data from root process to 4 other processes.

State and Explain the performance metric speed up , Efficiency , Throughput and Scalability

Explain in brief classification of parallel system based on memory access.

Discuss the categories of computers based on Handler’s classification.

Explain write-Invalidate Protocol with the help of diagram.

Explain Granularity, Concurrency and dependency graph.

Write MPI program for broadcast of data.

Explain the pros and Cons of Open MP.

Explain the Concept of Scatter and Gather.

Explain Quantum Computers.

Write a short note on Memory organization

Give the advantages in using non-uniform memory access model.

Explain the pros and Cons of Open MP.

Distinguish between loosely coupled and tightly coupled multiprocessors.

Discuss the categories of computers based on Flynn's classification.