1. What is meant by distributed computing?

The design and implementation of applications that are split into multiple processes running on multiple machines.

- Linked by a network
- Use software to produce an integrated computing facility
- Requires inter-process communication (IPC)
- Communicate and coordinate actions by passing messages

![Distributed Computing Diagram]

2. What are the advantages of distributed computing?

- Better/more efficient utilisation of resources
  - Make use of powerful modern desktop PC clients
  - Can put processing closer to where it is needed
  - e.g. GUI processing on client, database on data server

- High performance computing, grid computing
  - Parallel processing over a network or in a supercomputer

- High availability/reliability/scalability in computing
  - Redundancy, decentralisation (e.g. Internet services)

- Load balancing (e.g. server cluster)
  - Load balancing is a computer networking method for distributing workloads across multiple computing resources.

3. What is an IPC method? List some IPC methods known to you.

- Inter Process Communication (IPC) is a set of methods for the exchange of data among multiple threads in one or more processes.
- These processes may be running on one or more computers connected by a network.

**IPC Methods**

- message passing
- synchronization
- shared memory
- remote procedure calls (RPC)
4. What is RPC? Explain with a diagram how the RPC works.

- The client application makes a request (just like calling a normal function).
- This request forwards to the stub.
- Stub is responsible for marshalling the request (Make the request ready for network transferring)
- Then this marshaled request is sent over the network to the server side by RPC Library (Does the network communication).
- With that the stub blocks until the response comes or error detected.
- Server side receives the request and examines the request to understand the requested function.
- Then un-marshalling of the received message happens (parameters etc.)
- With these un-marshaled information, the required server side function is called.
- As the function returns, the return value and output parameters are marshaled back and sent to the client side.
- Client receives this marshaled response.
- Stub un-marshals this response and return it to the client application as a normal function return.

5. Why remote procedure calls are designed to look just like a normal procedure call?

Don’t need to learn new skills or design principles.

6. Discuss one advantage and one disadvantage of this design.

Adv
Feels just like calling an in-process function.

Dis Adv
since RPC looks like a normal function call, it’s hard for the programmer to keep issues occur with RPC, always in mind.

7. List 5 names of popular component frameworks.

DLL
COM
EJB
.NET Components
Web Services and SOAP
8. What is a component?

Component is a collection of functions that work together. A component defines the smallest chunk of an application that can be moved to a remote server.

OR

A cohesive and self-contained subset of a system that provides a predefined service to other system components.

9. How does a component differ from an object?

<table>
<thead>
<tr>
<th>Object</th>
<th>Component</th>
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<tbody>
<tr>
<td>Detailed design</td>
<td>Architectural design</td>
</tr>
<tr>
<td>Compile time linking</td>
<td>Run time linking</td>
</tr>
<tr>
<td>Internal to application</td>
<td>Exposed to external clients</td>
</tr>
<tr>
<td>Data centric</td>
<td>Service centric</td>
</tr>
<tr>
<td>Source code must be compiled into application</td>
<td>Independently deployable unit of executable code</td>
</tr>
<tr>
<td>Implementation inheritance (Code reuse)</td>
<td>Implementation details are not exposed</td>
</tr>
</tbody>
</table>

10. List the RPC methods available in Java EE and Microsoft .NET

Java EE
Java RMI
Web services and SOAP

.NET
.NET Remoting
Web Services and SOAP