1. a) [2 points] State two advantages of multicore processors.

b) [2 points] State two advantages of single core processors.

c) [2 points] State two disadvantages of multicore processors.

d) [2 points] State two disadvantages of single core processors.
2. [2 points] We have seen that a multicore processor is MIMD in Flynn’s classification. Can a single core processor be anything else but SISD? If yes, give examples. If not, why not?

3. [3 points] Describe 3 different scenarios where an MPI program can have a deadlock.
4. Suppose that MPI COMM WORLD consists of the three processes 0, 1, and 2, and suppose the following code is executed (my_rank contains the rank of the executing process):

```c
int x, y, z;

switch(my_rank) {
    case 0:
        x=0; y=1; z=2;
        MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Send(&y, 1, MPI_INT, 2, 43, MPI_COMM_WORLD);
        MPI_Bcast(&z, 1, MPI_INT, 1, MPI_COMM_WORLD);
        break;
    case 1:
        x=3; y=8; z=5;
        MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
        break;
    case 2:
        x=6; y=7; z=8;
        MPI_Bcast(&x, 1, MPI_INT, 0, MPI_COMM_WORLD);
        MPI_Bcast(&y, 1, MPI_INT, 1, MPI_COMM_WORLD);
        MPI_Recv(&x, 1, MPI_INT, 0, 43, MPI_COMM_WORLD, &status);
        break;
}
```

a. [4 points] What will be the values of x, y, and z for each of the 3 processes after executing the above code?

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b. [2 points] Is there a possibility that the communication among the 3 processes be executed out of order? If yes, explain the reason. If not, why not?
c. [1 point] What will happen if we execute the above code with: mpiexec –n 4 (and MPI_COMM_WORLD will then contain 4 processes)?