

**BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR**  
**M.E. 1<sup>ST</sup> SEMESTER (IT) FINAL EXAMINATIONS, 2013**  
**Design of Operating System (ICE 904/4)**

**Full Marks: 70**

**Time: 3 hrs**

**Answer any five questions.**

- Q1. a) State the principle of locality. Differentiate between temporal locality and spatial locality. [4]  
 b) Assess the following program segment with respect to  
 i) temporal locality ii) spatial locality iii) locality of instruction fetch [6]

```
int sumarrayrows(int a[M][N])
{
    int i, j, sum = 0;

    for (i = 0; i < M; i++)
        for (j = 0; j < N; j++)
            sum += a[i][j];

    return sum;
}
```

- c) Design a Fibonacci system of memory allocation. [4]

- Q2. a) Explain one disadvantage of lazy buddy system. [2]  
 b) State the difference of loosely coupled system and tightly coupled system. [3]  
 c) Draw the schematic diagram of NonUniform Memory Access (NUMA) and Cache-Only Memory Architecture (COMA) and explain their basic differences. [7]  
 d) Describe a method of achieving cache coherence in UMA. [2]

- Q3. a) Discuss the following multiprocessor scheduling algorithms with respect to  
 i) parallelism and ii) processor affinity.  
 I. SNPF (Shortest Number of Processes First)  
 II. Round Robin Job Scheduling  
 III. Coscheduling (Gang Scheduling) [9]  
 b) Find the average waiting time when SRR (Selfish Round Robin scheduling) is used with  $a=2$ ,  $b=1$  for the following processes.

Process name	Arrival time	Service required
A	0	3
B	1	5
C	3	2
D	9	5
E	12	5

[5]

- Q4. a) Show how you can derive the progress graph of a critical section and subsequently its unsafe region. [6]  
 b) Explain a monitor with i) blocking condition variable ii) nonblocking condition variable (with schematic diagrams and notes on implementation). [8]
- Q5. a) In Unix, an entry in process table points to per process region table which in turn points to region table. Explain how independent processes share regions. [2]  
 b) Describe the advantages and disadvantages of buffer cache. [2+2]  
 c) Write and explain the different steps of the algorithm for creation of an unnamed pipe. [4]  
 d) Where are the read and write byte offsets maintained in case of pipe? Where are these offsets stored for regular files? What is the reason for it being different in case of pipes? [4]
- Q6. a) Show the different pointers and entries (including count values) in the User File Descriptor Table, File Table, and Inode Table for the following program.

```
#include <fcntl.h>
main()
{
    int i, j;
    char buf1[512], buf2[512];
    i = open("/etc/passwd", O_RDONLY);
    j = dup(i);
    read(i, buf1, sizeof(buf1));
    read(j, buf2, sizeof(buf2));
    close(i);
    read(j, buf2, sizeof(buf2));
}
```

- b) State the algorithm *iget* which allocates an in-core inode. [4]  
 c) In the algorithm *ialloc* for allocating inode from the file system, if the super block inode list is empty, the algorithm first locks the superblock. Why? [4]