Student ID:
Section: **Full Marks: 20**
Name: **Duration: 20 minutes**

1. A file system uses UNIX Inode data structure which contains 2 direct block, 2 single indirect, 1 double indirect, 2 triple indirect block. Size of each block is 64 bytes and size of each block address is 8 bytes. Find the maximum possible file size.   5

$$\# \text{ of pointers in one block} = \frac{64}{8} = 8$$

total # of pointer = # pointer in direct block + # of pointer in single indirect + # pointer in double indirect + # of pointer in triple indirect

$$= 2 + 2 \times 8 + 8^2 + 2 \times 8^3$$

$$= 2 + 16 + 64 + 1024$$

$$= 1106$$

∴ maximum size = $1106 \times 64 = 70784$ byte
$$= 69.125 \text{ KB}$$

2. Following is the implementation of reader writer problem using semaphore. Maximum 50 readers can read simultaneously whereas only one write can write. If a writer is waiting, subsequent readers are allowed to read. If at least one reader is reading, writer will wait till readers count becomes zero. What should be the statement at A, B, C, D and E, so as to work this correctly and all readers after 50 will wait in the same queue?   5

Reader Code:

```
do{
    wait( mutex );
    read_count++;
    if( read_count == 1)
        wait( rw_mutex );
    A: signal( mutex )

    /* reading is performed */

    B: wait( mutex )
```

```
        read_count--;
        if (read_count == 0)
            signal( rw_mutex );
    C: signal( mutex )
}while(true)
```

Writer Code:

```
do {
    D: wait ( rw_mutex )

    /* writing is performed */

    E: signal (rw_mutex)
} while(true);
```

3. Explain the deadlock situation in Dining-Philosopher problem. Suggest a solution to avoid the deadlock problem.   5

Sol1: first odd, then even

Sol2: everyone takes left first except the last philosopher.

Sol3: if left and right both available, then takes the chopsticks, otherwise don't take either one

4. Show the overall organization of a very simple file system. Show the data region, inodes and bitmap.   5