Solution (II midterm OS Solution)

Ans 1.

X:	Y:	Z:
P(b)	P(b)	P(a)
P(a)	P(c)	P(c)
P(c)	P(d)	P(d)

Ans 2.

```
monitor ReadersWriters
    condition OKtoWrite, OKtoRead;
    int ReaderCount = 0;
    Boolean busy = false;


  procedure StartRead()
  {
    if (busy)                   // if database is not free, block
      OKtoRead.wait;
    ReaderCount++;                        // increment reader ReaderCount
    OKtoRead.signal();

  }

  procedure EndRead()
  {
     ReaderCount-- ;                   // decrement reader ReaderCount
     if ( ReaderCount == 0 )
        OKtoWrite.signal();
  }


  procedure StartWrite()
  {
    if ( busy || ReaderCount != 0 )
       OKtoWrite.wait();
    busy = true;
  }

  procedure EndWrite()
  {
    busy = false;
    If (OKtoRead.Queue)
      OKtoRead.signal();
    else
```

```
    OKtoWrite.signal();
 }

Reader()
{
   while (TRUE)                // loop forever
   {
      ReadersWriters.StartRead();
      readDatabase();          // call readDatabase function in monitor
      ReadersWriters.EndRead();
   }
}

Writer()
{
   while (TRUE)                // loop forever
   {
      make_data(&info);              // create data to write
      ReaderWriters.StartWrite();
      writeDatabase();         // call writeDatabase function in monitor
      ReadersWriters.EndWrite();
   }
}
```

Ans 3.

Process	Allocation	Max	Available	Need	Work	Available (R)	Need (R)	Work (R)
	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
P_0	4 1 0 0	6 5 6 0	4 13 18 2	2 4 6 0	8 14 18 2 (1)	4 11 14 2	2 4 6 0	8 12 14 2 (1)
P_1	2 3 6 0	2 5 6 0		0 2 0 0	10 17 24 2 (2)		0 2 0 0	10 15 20 2 (2)
P_2	4 5 3 1	6 5 3 2		2 0 0 1	14 22 27 3 (3)		2 0 0 1	14 20 23 3 (3)
P_3	2 1 0 0	2 1 0 0		0 0 0 0	16 23 27 3 (4)		0 0 0 0	16 21 23 3 (4)
P_4	0 0 0 1 0 2 4 1	0 5 7 1		0 5 7 0	16 23 27 4 (5)		0 3 3 0	16 23 27 4 (5)

Safe Sequence is < P0, P1, P2, P3, P4 >

After request from process P4 for (0,2,4,0) , safe sequence is <P0, P1, P2, P3, P4>

Ans4

(a) 22 bits

(b) 4 KB

(c) 2^{20} entries

(d) 10 bits

Ans5

150 = h (10 + 100) + (1-h) (10 + 100 + 100)

100 h = 60

h= 0.6 (60 %)