Theory

1.

```
semeaphore q = 0
semeaphore r = 0
semeaphore p = 1
Process P {
    while ( true ) { //
        wait(p)
        print("P:RED");
        signal(q)
    }
}
Process Q {
    while ( true ) { // Insert synchronization code
        wait(q);
        print("Q:WHITE");
        signal(r);
    }
}
Process R {
    while ( true ) { // Insert synchronization code
    wait(r)
    print("R:BLUE");
    signal(p)
    }
}
```

2.
a. $(12 + 6) * 2 = 36$ minutes.
b.
   Best case: $6 + 6 + 12 = 24$
   Worst case: $6 + 6 + 12 + 12 = 36$

3.

Consider a system in which a page can store 200 integers. On this system a small program that operates on a two-dimensional matrix A is executed. The program code resides in page 0, which corresponds to addresses 0 through 199. This page is always kept in the physical memory.

A is defined as: int A[ ] [ ] = int [10][200];

where A[0][0] is at the logical address 200 and the matrix is stored in the memory in the row-major form.

Consider the following two ways to initialize this matrix. For each of these two cases answer the following:

Identify the pattern in page reference strings these two initialization routines would generate for accessing matrix A. You may just identify the pattern that gets repeated because there may be several hundred page references.

Initialization 1:

```
for (int i =0; i< 10; i++)
     for (int k =0; k < 200; k++)
            A[ i ] [ k ] = 0;
```

1 2 3 4 5 6 7 8 9 10

Initialization 2:

```
for (int k =0; k < 200; k++)
     for (int i =0; i< 10; i++)
            A[ i ] [ k ] = 0;
```

1 2 3 4 5 6 7 8 9 10… return to 1 2 3 4 5 6 7 8 9 10 and repeat

4.

Maximum number of bytes addressed by 10 direct pointers is

   = Number of direct pointers * Blocksize
   = 10 * 1028 bytes
   = 10280 bytes

Maximum number of bytes addressed by single indirect pointer is

   = NumberOfEntries * BlockSize
   = 256 * 1028 bytes

= 263168 bytes

Maximum number of bytes addressed by double indirect pointer is

= NumberOfEntries^2 * BlockSize
= (Blocksize / BlockNumberSize)^2 * BlockSize
= 256 ^2 * 1028 bytes

Maximum number of bytes addressed by triple indirect pointer is

= NumberOfEntries^3 * BlockSize
= 256^3 * 1028 bytes

Maximum file size is 10 * 1028 + 256 * 1028 bytes + 256 ^2 * 1028 bytes + 256^3 * 1028 bytes