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OS 2019 Quiz Sheet #3

Problem 3.1: *semaphore pattern* (1+3 = 4 points)

a) Explain the concept of a barrier.

b) Outline how a simple barrier can be implemented using counting semaphores.

Problem 3.2: *readers / writers problem* (2+2+2 = 6 points)

Below are three incorrect solutions of the readers-writers problem. Explain in which situations the solutions fail to work correctly. Below are some common definitions:

```
shared object data;
shared int readcount = 0;
semaphore mutex = 1, writer = 1;
```

a)

```
void reader()
{
    down(&mutex);
    readcount = readcount + 1;
    if (readcount == 1) down(&writer);
    up(&mutex);
    read_shared_object(&data);
    down(&mutex);
    readcount = readcount - 1;
    up(&mutex);
    if (readcount == 0) up(&writer);
}
```

```
void writer()
{
    down(&writer);
    write_shared_object(&data);
    up(&writer);
}
```

b)

```
void reader()
{
    down(&mutex);
    readcount = readcount + 1;
    if (readcount == 1) down(&writer);
    up(&mutex);
    read_shared_object(&data);
    down(&mutex);
    readcount = readcount - 1;
    if (readcount == 0) {
        up(&mutex);
        up(&writer);
    } else {
        up(&mutex);
    }
}
```

```
void writer()
{
    down(&writer);
    write_shared_object(&data);
    up(&writer);
}
```

c)

```
void reader()
{
    down(&mutex);
    readcount = readcount + 1;
    if (readcount == 1) down(&writer);
    up(&mutex);
    read_shared_object(&data);
    down(&mutex);
    readcount = readcount - 1;
    if (readcount == 0) up(&writer);
    up(&mutex);
}
```

```
void writer()
{
    down(&writer);
    down(&mutex);
    write_shared_object(&data);
    up(&mutex);
    up(&writer);
}
```