COM S 352 Homework 6

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March 23, 2021

Question 1

```
monitor accessManager
{
    int limit = 0;
    condition connection[];
    void init(int n)
    {
        limit = n;
        condition connection[n];
    }

    void request(int n)
    {
        for(int i = 0; i < n; i++)
        {
            if(connection[i] == OPEN)
                wait(limit);
        }
    }

    void release(int n)
    {
        for(int i = 0; i < n; i++)
        {
            connection[i].signal;
        }
    }
}
```

Question 2

r_sem counts the number of reading processes, while **w_sem** counts the numer of writing processes. These semaphores prevent starvation by not allowing additional processes of the same type to run. For example, if there are 5 writing process running and 6 reading processes waiting, these semaphores will now allow an additional writing process to run. The additional writting process will be foreced to wait.

Question 3

```
int serve, int order, int eat;
void init() {
    serve = 0;
    order = 1;
    eat = 0;
}

void chef() {
    while (true) {
        wait(serve);
        signal(eat);
    }
}

void customer() {
    wait(seats);
    wait(order);
    signal(serve);
    wait(eat);
    signal(order);
    signal(seat);
}
```

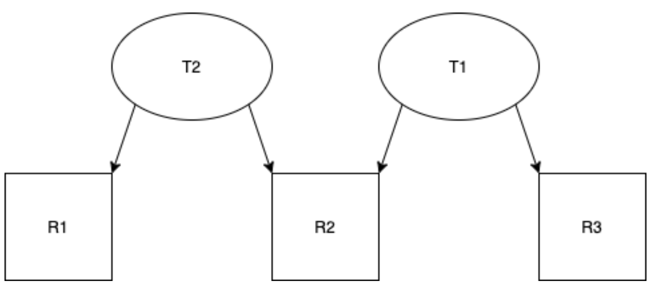
Question 4

a.

- *Mutual Exlcusion*
  Only a single street of cars can use the resource they are on
- *Hold & Wait*
  Each line of cars is *holding* a resource (the street) and *waiting* for the perpendicular street to open up
- *No Preemption*
  A resourcd cannot be released until the entire line of cars have passed
- *Circular Wait* If we label each set of vehicles, v1, v2, v3, v4, then, v1 waits for v2, v2 waits for v3, etc... resulting in a circular wait

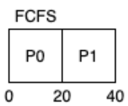
b. A rule to ensure no deadlocking could be to remove any sort of preemption. This would force each process to wait until its next resources are available. If a process makes a request but the request is not satisfied it will need to make the request again once the resources are available.

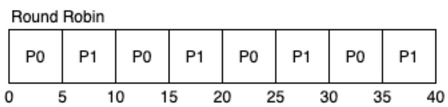
Question 5



This diagram shows that there is no way to have a cycle which, means that this system is deadlock free.

Question 6





The Round Robin algorithm could result in deadlock. If P_0 uses S and P_1 uses Q then they will both be waiting which means P_0 wont be able to use Q and P_1 can't use S. The FCFS algorithm is sequential however, which results in no deadlock.

Question 7

- **a.**
  No deadlock because no cycle is present. A possible execution plan could be:
  T_2 –> T_3 –> T_1
- **b.** This graph is deadlocked. The cycle is:
  T_1 –> R_3 –> T_3 –> R_1 –> T_1
- **c.** No deadlock because no cycle is present. A possible execution plan could be:
  T_3 –> T_1 –> T_2
- **d.** This graph is deadlocked. The cycle is:
  T_1 –> R_2 –> T_3 –> R_1 –> T_1
- **e.** No deadlock because there is no hold and wait condition. A possivle execution plan could be: T_2 –> T_1 –> T_3 –> T_4
- **f.** No deadlock, R2, has 3 available instances and 3 connecting threads. A possible execution plan could be: T_2 –> T_4 –> T_1 –> T_3