1995 Paper 10 Question 7

Operating System Foundations

Why are multiple buffers often used between producing and consuming processes? [4 marks]

Describe the operation of a *semaphore*. [4 marks]

What is the difference between a counting semaphore and a binary semaphore? [2 marks]

The code below is intended to synchronise buffer control between multiple producing processes and a single consuming process. `freeBuffer` and `fullBuffer` are semaphores. Describe an execution sequence which causes error.

Initialisation:

```
current_free := 0;
current_full := 0;
freeBuffer := buffers;
fullBuffer := 0;
```

Producers:

```
LOOP
     produce item;
     WAIT(freeBuffer);
     COPY (buffer[current_free], item);
     current_free := (current_free + 1) MOD buffers;
     SIGNAL(fullBuffer);
END;
```

Consumer:

```
LOOP
     WAIT(fullBuffer);
     COPY (item, buffer[current_full]);
     current_full := (current_full + 1) MOD buffers;
     SIGNAL (freeBuffer);
     consume item;
END;
```

[5 marks]

Modify the code to correct the problem. [5 marks]