COMP 730 Midterm Exam

Spring 2007

There are 5 questions; answer all of them. If you need to make an assumption to clarify a problem, *write your assumption down*. Only reasonable assumptions get full credit. *Explain all answers.* You have one hour and 15 minutes to finish the exam. The questions are of varying difficulty; so it is probably advisable to answer the easier questions first to avoid getting stuck on the harder ones. *Good Luck!*

1. Define preemption events, granularity of preemption, and wakeup (or timer) events. What factors govern the choice of the granularity of preemption? (15 pts.)

2. Outline a scheme for servicing wakeup events with constant ($O(1)$) per-tick cost. What is the cost of scheduling a wakeup event under this scheme? You can assume for both Q2 and Q3 that a constant number of processes block for the same wakeup event. (15 pts.)

3. Suppose wakeup events are always set for periods less than *MaxInterval*. Outline a scheme for servicing wakeup events which has both constant cost per-tick and constant cost for scheduling a wakeup event. (Hint: You can tradeoff space for time.) (15 pts.)

Consider the following code:

```
program Room;
boolean isOpen = false;
int numberOfEntries = 0;
/* definitions of open, close, enter, and leave */
                  ...
begin
      loop
            select
                  when not isOpen receive openMsg()
                        open();
                        isOpen <- true;
                  end
                  when isOpen receive enterMsg();
                        enter();
                        numberOfEntries++;
                  end
                  when numberOfEntries > 0 receive leaveMsg();
                        leave();
                        numberOfEntries--;
                  end
                  when numberOfEntries = 0 and isOpen receive closeMsg();
                        close();
                        isOpen <- false;
                  end
            end
      end
end
```

4. Using the above example, describe and illustrate the semantics of a guarded select. Why is it useful? (15 pts.)

5. Write a path expression, involving the procedures open(), close(), enter(), and leave(), that describes the synchronization implemented by the code above. Definitions of these procedures are not given here, and should not matter in your solution. You can assume that these procedures do not change the variables, *isOpen* and *numberOfEntries*. If you do not remember the syntax for the path expression operators, invent your own, and explain what it is. (15 pts)