COMP 3500: Homework 1

Points Possible: 100
Note: You do not need to submit hard copies.

Goals:

- To learn multiple processes.
- To understand critical sections.
- To learn the concepts of semaphores and monitors.
- To collaborate and discuss concurrency problems with your group members.

Questions:

1. [50 points] Consider the following program:

```
P1: {
  shared int x;
  x = 10;
  while (1) {
     x = x - 1;
     x = x + 1;
     if (x != 10)
       printf("x is %d",x)
  }
}
```

```
P2: {
  shared int x;
  x = 10;
  while ( 1 ) {
    x = x - 1;
    x = x + 1;
    if (x!=10)
      printf("x is %d",x)
  }
}
```

Note that the scheduler in a uniprocessor system would implement pseudo parallel execution of these two concurrent processes by interleaving their instructions, without restriction on the order of the interleaving.

1.1. [25 points] Show a sequence (i.e., trace the sequence of interleavings of statements) such that the statement "`x is 10`" is printed.

1.2. [35 points] Show a sequence such that the statement "`x is 8`" is printed.

You should remember that the increment/decrements at the source language level are not done atomically, that is, the assembly language code:

```
LD R0,X /* load R0 from memory location x */
INCR R0 /* increment R0 */
STO R0,X /* store the incremented value back in X */
```

2. [10 points] What is the difference between binary and general semaphores?

3. [10 points] What is a monitor?

4. [20 points] What operations can be performed on a semaphore?

Submission:

- A heading at the top of your file contains your group ID, the names of your group members, and your Auburn UserIDs.
- Submit your solution as a PDF file named as ""<group_ID>_hw1.pdf" through Canvas (for example, mine might read "group06_hw1.pdf")
- Each group must submit a single PDF file that contains:
    - Group member 1's answers
    - Group member 2's answers
    - Group member 3's answers
    - Group answers after your discussion
- If the three group members' answers agree with one another, you simply pick the answer with better presentation as your group answers.
- If the three members' answers are different, the group members have to discuss and determine whose answer is correct. The correct one should be submitted as the group answer.
- In the above two cases, your team must clarify whose answers are adopted.
- TA will only grade your group answers. However, if you (1) do not provide each member's individual answers or (2) you do not clarify whose answers are adopted, your team will **lose 20 points**. Although your group members may share different answers, the group members should have an agreement on the group answers.

Late Submission Penalty:

- Ten percent (10%) penalty per day for late submission. For example, an assignment submitted after the deadline but up to 1 day (24 hours) late can achieve a maximum of 90% of points allocated for the assignment. An assignment submitted after the deadline but up to 2 days (48 hours) late can achieve a maximum of 80% of points allocated for the assignment.
- Assignment submitted more than 3 days (72 hours) after the deadline will not be graded.

Rebuttal period:

- You will be given a period of one week (i.e., 7 days) to read and respond to the comments and grades of your homework or project assignment. The TA may use this opportunity to address any concern and question you have. The TA also may ask for additional information from you regarding your homework or project.