

# CS1356 Introduction to Information Engineering

## Homework 5

Due: Dec 16, 2009 in class

Remember to write your name and student ID

1. We call a DVD is played smoothly if it can be played 30 frames per second *uniformly*. Suppose you want to play two DVDs simultaneously on a single core computer, which takes 10ms to display a frame, and takes 1ms for context switch. What is the longest length of a time slice to make both DVDs played smoothly? Assuming no other programs are executed at the same time. And what is the shortest length of a time slice to do so? Justify your answers. (20%)

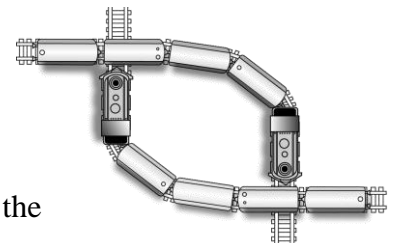
2. A *barrier* for a group of threads/processes in the source code means any thread/process must stop at this point and cannot proceed until all other threads/processes reach this barrier. The following code uses a global variable `count`, whose initial value is 8, to implement a barrier for 8 threads/processes. (20%)

- (1) Give an example to show this code could fail in a single CPU multitasking environment.
- (2) How to fix this code to make it work? Justify your answers.

```
count = count - 1;
while (count > 0);
// barrier point
```

3. Textbook uses an example to illustrate the deadlock situation, as shown in the figure. The solutions to resolve deadlock are attacking one of the following conditions.

- (1) Competition for non-sharable resources
- (2) Resources requested on a partial basis
- (3) Allocated resources cannot be forcibly retrieved.
- (4) Circular wait.



For each condition, can you think a solution to attack it so that the deadlock is resolved? Your solutions CANNOT change the topology of the railroads, but you can add new facilities to it, or design new rules for train operations. (40%)

4. CAPTCHA (*Completely Automated Public Turing test to tell Computers and Humans Apart*) is a system designed to distinguish computer and human. A common type of CAPTCHA requires user to type letters or digits from a distorted image, as the following one. (20%)

- (1) Nowadays, this technique is often used with the authentication process. What kind of security attack can this mechanism prevent?



- (2) Explain how this technique can be used to attack (email) spam filters?