

CS6235

Assignment 1

The assignment expects that students will write their own code. All the Java codes snippets - should be valid Java code that is compilable using a Java compiler. Compile your code, test it and only then use it in the assignment.

1. [10+10] Write Java code snippets to show (i) data-races, (ii) how atomicity violations can exist despite race freedom (using `synchronized` blocks or methods).
2. [10+5] Write a Java program and use it to illustrate Amdahl's law. Show the execution time numbers to empirically establish the law. You may use any multi-core system (with at least 8 cores) for the experiment.
3. [5] Write a Java program to prove that Java threads share the heap.
4. [10+10] For the code written in Q1(i) and Q1(ii): show the static Happens Before (HB) relation between the different Java statements. You would need to add a line number to each line in the Java code to illustrate the HB relation.

Note: (1) If two statements `S1` and `S2` may run in parallel with each other - they have no HB relation. Else, either `S1 HB S2` and/or `S2 HB S1`. (2) While analyzing a program statically, unlike the actual execution, there will be cases where we may say that two statements `S1` and `S2`, may have HB relation with each other in both directions (that is, `S1 HB S2` and `S2 HB S1`).

5. [10+10] Write a Java program that leads to a deadlock due to parallelism related constructs: (i) uses threads, and synchronized methods. (ii) uses threads and cyclic-barriers.