

PEER-LED TEAM LEARNING COMPUTER SCIENCE

MEETING 7 – STUDENT VERSION ITERATION

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Exercise 1: Simulating multiplication

In early computers, there were no multiplication operations in the instruction set. Instead, multiplication of integers was accomplished through successive addition in software.

- How would you calculate a product using successive addition? Write a flow chart to show how to calculate $4 * 5$.
- Now think about the more general problem of calculating $K*N$ where K and N are both integers. Alter the original flow chart so that it solves this more abstract problem.
- What is the Java code that corresponds to this flow chart?

Exercise 2: Mystery loop

Given the following mystery loop in Java, hand simulate it and figure out what it does. Assume n is an integer.

```
do
{
    if ((n%2) == 0) { System.out.println(0);}
    else {System.out.println(1)};
    n = n / 2;
} while (n != 0)
```

- A good idea for determining the function of this code is to try it out on some inputs for n . So, hand simulate this code for $n = 5$ and $n = 8$. Can you tell what it computes?
- What would be good test cases for this code? Why?

Exercise 3: Prime numbers

- a. We want to write an algorithm that given an integer n can tell if n is *prime*. Think of a solution procedure that can answer this question.
- b. Flowchart your algorithm as a group.
- c. Code your algorithm in Java. You may need to use some methods from the Java libraries.

Exercise 4: Making drawings with loops

This exercise involves using loops to draw different shapes.

- a. Describe a nested loop that will draw a square on output by printing m lines of m stars (*) on the page.
 - o Draw a flow chart of your nested loop.
 - o Code your loop in Java and run it to see if it ‘works’.
 - o How would the algorithm change if you wanted to draw a ‘hollow’ square?
 - o How would the algorithm change if you wanted to draw a rectangle that is m by k instead of a square?
- b. What if you wanted to draw a triangle? How would you have to change the program for a rectangle to draw a triangle?
- c. Now consider drawing a circle using a loop. How would you do this task? (Hint: you may need to use your knowledge of geometry and some specialized functions in the Java library.)
- d. Using our drawing program methods, code your algorithm from part c in Java. Try your program on a sample radius of size 50 and observe the results on the screen.

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