ASSIGNMENT 1

COMP-202B, Winter 2008, All Sections

Due: Wednesday, January 23, 2008 (23:55)

You **MUST** do this assignment individually and, unless otherwise specified, you **MUST** follow all the general instructions and regulations for assignments.

Graders have the discretion to impose penalties to students who deviate from the general instructions and regulations; these penalties will take the form of deductions from the marks allocated for respect of instructions and regulations.

Part 1, Question 1:	0 points
Part 2, Question 1:	50 points
Part 2, Question 2:	30 points
Part 2, Question 3:	20 points
	100 points total

Part 1 (0 points)

Do **NOT** *hand in this part, as it will not be graded. However, doing this exercise might help you to do the second part of the assignment (that will be graded). If you have difficulties with the questions of Part 1, then we suggest you go to one of the office hours; the TA can help you and work with you through the warm-up questions.*

Warm-up Question 1 (0 points)

Suppose you know Merlin, an all-powerful wizard who provides you with the following curious method for multiplying any two numbers between 100 and 109: [1]

1. The most significant digit will always be 1.
2. The next two significant digits will be the summation of the least significant digits of the the inputs.
3. The final two digits will be the product of the least significant digits of the inputs.

Some examples:

- First example: $105 \times 107 = 11235$:

  First Step: The most significant digit is 1

  Second Step: The next two significant digits will be $12 : 5 + 7 = 12$

  Third Step: The final two digits will be 3 and 5 since $5 \times 7 = 35$.

Write a program that prompts the user to enter two integers between 100 and 109 and then computes their product using Merlin's method and outputs the result.

Part 2 (50 + 30 + 20 = 100 points)

The questions in this part of the assignment will be graded.

[1] http://mikesmath.com/shortcuts.htm

Question 1 (50 points)

Suppose in 2100 an astronaut bids adieu to his twin sister and travels to planet X which is at distance d from the Earth. If his space transport can travel at speed v (which is close to the speed of light) and the journey takes t number of years to complete, theory of special relativity tells us that he'd have aged less than his twin sister. Namely, instead of his sister who is t years older, he 'd have aged $t * \epsilon$ years where $\epsilon = \sqrt{1 - (\frac{v^2}{c^2})}$ and c is the speed of light. Write a program that first prompts the user to enter

- the speed of his shuttle (For instance, at 85 percent of the speed of light: $v = 0.85c$) and
- the distance d to planet X.

Then, your program should calculate and display

- the time on earth that has passed: $t = \frac{2d}{v}$
- the time that the astronaut has aged: $t\epsilon$

You may assume that the distance is given in terms of miles[2] and $c = 5.88 \times 10^{12}$ miles per year.To compute the square root of a (non-negative) number, use Math.sqrt (for instance, Math.sqrt(4) will return 2). Save your TwinParadox class in a file called TwinParadox.java and submit this file to WebCT.

Question 2 (30 points)

Professor Mirrorolvsky would like you to assist him by writing a program that lets him figure out the inverse of any particular student number. Your program should prompt the user to enter their student number (a 4-digit number) and should display the inverse. For instance, if the student number is 2650, then your program should display 0562. You may assume that the user enters a proper input in the correct format. Save your InvertID class in InvertID.java and submit this file to WebCT.

Question 3 (20 points)

A student writes the following code segment to swap the values of two variables called firstValue and secondValue:

```
int firstValue = 10;
int secondValue = 30;
firstValue = secondValue;
secondValue = firstValue;
```

Does his code accomplish this task? If yes, describe why. If not, write a short code segment that swaps the values of the two variables. Write your reply in a text file called q3.txt and submit it to WebCT.

[2]Although astronomical distances are usually measured in light years