Revenge of GTY

-VG101 Final Reviewing Exercises

1. GTY wants to attend the Christmas dancing party, but he cannot afford the ￥12.15 fee, so he decides to borrow the money from his friends. Please help GTY to record the information of borrowing in an *account.txt* file*,* following the alphabetical order of his friends' name (otherwise he may forget to pay back). You should keep inputting the names and the money until the total money >= 12.15. It's ensured that all friends have different names and all the names are capitalized. Ps., Always show two digits after the decimal point when expressing money.

   Sample Input (from screen):
   Jeffery 3.3
   Tom 5.24
   Mindy 0.01
   Mary 4.15

   Sample Output (to *account.txt*):
   Jeffery 3.30
   Mary 4.15
   Mindy 0.01
   Tom 5.24

2. Eventually, GTY digs up enough money to attend the party, but when he arrives, he finds that himself to be the only person who comes alone (so sad) – all others are in couples. In the party, every participant is given a serial number (integer from 1 to 10000), and the couples have the same serial number. Please write a program accepts inputs of the serial numbers of all participants (input 0 to indicate the end) and outputs the serial number of GTY.

   Sample Input (from screen):
   520
   999
   1111
   999
   520
   0

   Sample Output (from screen):
   1111

3. For revenge, GTY decides to release the final grades of VG101 students on the party, and he wants to select a time when there's the most students in the dancing hall, so that he can see the expression on everyone's face. His strategy is like this:

(1) First wait for T minutes and find out the maximum number of students M within this T minutes.

(2) After T minutes, if the number of students >= M, release the grade immediately. If such situation does not happen, release the grade at the end of the party. Let N denote the number of students when the grade is released.

Suppose that the party lasts for 100 minutes and there's always 100 people (except GTY) in the hall. At every minute, one person leaves and one person comes, randomly and independently. Suppose that the possibility that a participant is a student in the VG101 class is P. Given P and the initial number of VG101 students S.

Use Monte Carlo method to find T that gives the highest expectation of N. The recommended time of stimulation is 100000.

Sample Input (P and S, on screen):
0.2 18

Sample Output (the best T, on screen)
52

4. Suppose that the dancing hall has the shape of two overlapping circles with radius r1 and r2, centered at A(x1, y1) and B(x2, y2). As shown in the figure below, GTY must stay in the dark blue area so that he can see all the students in the hall. To make your life easier, let's assume that |AB| > r1, r2, so the dark blue region is inside the two circles.
Please implement the class *Circle* to find the area of the dark blue region.
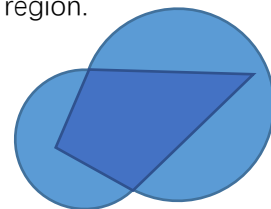

```cpp
class Circle
{
    double x, y, r;
    double center_distance(const Circle& circ);
    //IMPLEMENT NEEDED! returns the distance between the center of *this and circ
    double public_chord_length(const Circle& circ);
    //IMPLEMENT NEEDED! returns the length of the intersecting chord of *this and circ
public:
    Circle() : x(0), y(0), r(1) {};  //default constructor
    Circle(double _x, double _y, double _r);
    //IMPLEMENT NEEDED! set the private data members
    double getArea(const Circle& circ);
    //IMPLEMENT NEEDED! returns the area of the dark blue region formed with circ
};
```

Sample Input (in main function):
```cpp
Circle circ1(0, 0, 1), circ2(1, 0, 1);
cout << circ1.getArea(circ2) << endl;
```

Sample Output (shown on screen)
2.59808

5. After the party, GTY starts fulfilling his last task as a TA, curving students' grades. To do this, he needs to know some properties of polynomials - for example, the null points (x0 that lets p(x0)==0). Please write a program that allows GTY to input a polynomial of maximum degree 9 and integer coefficients, as well as two numbers a and b (a<b). Suppose that p(a)*p(b)<0, and there's only one null point in the interval [a, b]. Then, output the null point, with precision 1e-6.

Sample Input (on screen):
2x2+x4-5x+1
1 3

Sample Output (on screen):
1.20684