

Junior Knights Review Homework for Programming Contest (Due 11/30/2012)

Problem A (5 points): Movie Tickets (movie.py)

It's Christmas time and you're taking your whole family to the movies! To make your task easier, you want to write a program that determines the cost of the tickets. Child tickets cost \$7 per ticket and Adult tickets cost \$10 per ticket, with tax already included. Write a program to ask the user how many adult and child tickets they want to buy and print out the total cost of their purchase.

Input and Output Restrictions

The user will enter two non-negative integers less than 100. Your program output should follow the sample below and output the total cost as an integer number of dollars.

Sample Run

```
How many child tickets do you want?  
3  
How many adult tickets do you want?  
7  
Your cost will be $91.
```

Problem B (5 points): Movie Ticket Discounts (discount.py)

You've been buying so many movie tickets, you believe that you deserve a discount! You ask the manager at the movie theater and she agrees to implement a discount for large purchases. In particular, if a single purchase contains in between 10 and 24 tickets, inclusive, a 10% discount will be given. If a single purchase contains 25 or more tickets a 25% discount will be given. The original prices of tickets are still the same as in problem A. Given this discounting system, determine the cost of the tickets.

Input and Output Restrictions

The user will enter two non-negative integers less than 100. Your program output should follow the sample below and output the total cost as a double rounded to 2 decimal places.

Sample Run

```
How many child tickets do you want?  
3  
How many adult tickets do you want?  
7  
Your cost will be $81.90.
```

Problem C (5 points): Fish Tank Glass (fishtank.py)

You work for a large aquarium and are helping them decide some parameters for a new fishtank they are buying. In particular, you need to help them calculate the cost of a fishtank and the amount of water (in cubic inches) that will fit in it.

A fishtank is made out of five panes of glass. (The top is left open, so no pane of glass is needed for the top.) The cost of a pane of glass is based on the area of its main surface. In particular, one square inch of glass costs 15 cents. (This is a high price, but the glass used for large fishtanks is special glass that is very strong.) Thus, a 4" x 8" pane of glass would cost $4 \times 8 \times \$0.15 = \4.80 .

The user will enter the length, width and height of the proposed fish tank in inches.

Input and Output Restrictions

The dimensions the user will enter will be in inches and each value will be a positive integer less than 200. Your program output should follow the sample below and output the total cost of building the fish tank to the nearest cent as well as the volume of water it can hold, in cubic inches, as an integer.

Sample Run

Enter the length, width and height of the fish tank in inches.

18 36 24

Your cost for building the tank will be \$486.00.

The volume is 15552 cubic inches.

Problem D (10 points): Paper Folding (fold.py)

If you take a piece of paper and fold it in half, then fold it in half again, and again and so on, the paper becomes thicker each time. Assuming you can continually fold the paper (it has been said you can only fold a piece of paper in half 8 times, it is referred to as the “Folding Paper Problem”) the thickness of it will exponentially grow. After 50 folds of a standard piece of paper (0.1 mm thick) it would be nearly the distance from the Earth to the Sun (1.475×10^{11} meters).

Input and Output Restrictions

Prompt the user for the thickness of the piece of paper, the number of folds they want to perform on a given sheet of paper and a fold increment value. The thickness (**in millimeters**) will be a positive real number less than 100. The last two numbers will both be positive integers and have a product less than or equal to 50. You'll print out a chart labeled with the number of folds, which increments by the given value, and the thickness of the paper (**in meters**) for each fold. The number of folds will be a non-negative integer and the thickness should be printed in meters to 6 decimal places. (Note: 6 decimal places is the default output for printing a double.)

Sample Run

How thick is your sheet of paper (in millimeters)?

.1

How many times would you like to fold the paper?

50

What increment would you like to use for the table?

10

Folds	Thickness
0	0.000100
10	0.102400
20	104.857600
30	107374.182400
40	109951162.777600
50	112589990684.262405

Problem E (10 points): Difference of Sums (sumdiff.py)

The sum of squares of the first 3 natural numbers is

$$1^2 + 2^2 + 3^2 = 14$$

The square of the sum of the first 3 natural numbers is

$$(1 + 2 + 3)^2 = 36$$

The difference between these two is $36 - 14 = 22$. (Note that the latter is always greater than or equal to the former.) Your task is to write a program that computes the difference between the square of the sums and the sum of the squares for natural numbers in a given range.

Input and Output Restrictions

The user will enter two positive integers less than or equal to 1000. The first integer (minimum) will be less than or equal to the second integer (maximum). The range described will be inclusive. Hence, the range of values from 3 to 5 includes 3, 4 and 5. Follow the input and output format below and output the difference as a non-negative integer.

Sample Run

Enter the minimum value of the range.

5

Enter the maximum value of the range.

15

The desired difference is 10890.

Problem F (10 points): Number of Tiles (tiles.py)

You are attempting to tile a room with square tiles. You are given the dimensions of the room in feet (length and width). In addition, you are given the number of feet on the side of a single tile. Given this information, your goal is to figure out the maximum number of tiles (without any cutting) that fit on the floor of the room. For example, if the room was 9' x 6' and each tile was a 2' x 2' tile, then 12 tiles would fit. (A 4 by 3 tile design would fit. No more tiles would fit in either dimension.)

Input and Output Restrictions

All values entered will be positive integers less than 500.

Sample Run

Enter the dimensions of the room, in feet.

9 6

Enter the length of the side of a tile, in feet.

2

You can place a maximum of 12 complete tiles.

Problem G (15 points): Flag Designs (flag.py)

The US flag has stars for each state on it. They are arranged such that the odd numbered rows have 6 stars and the even numbered rows have 5 stars. Given the number of stars and a total number of rows (which is always odd), one can determine whether or not a star pattern like the US flag is possible. Your job is to determine this. If it's possible, print out the star design.

Input and Output Restrictions

The user will enter a positive integer for the number of stars that is less than 1000. The user will enter a positive **odd** integer for the number of rows that is less than 1000. If there is no valid configuration of stars for the numbers entered, output the following sentence.

Sorry, no star design fits your specification.

Otherwise, print out the star design, with a single space between each star on each row. For example, the star design for the US flag (50 stars, 9 rows), should be printed as follows:

```
* * * * *
 * * * *
* * * * *
 * * * *
* * * * *
 * * * *
* * * * *
 * * * *
* * * * *
```

Sample Run

Enter the number of stars for your design.

50

Enter the number of rows for your design.

13

Sorry, no star design fits your specification.

Sample Run

Enter the number of stars for your design.

29

Enter the number of rows for your design.

3

```
* * * * *
 * * * *
* * * * *
```

Problem H (15 points): Arup's Pseudoprimes (fakeprimes.py)

Many students think that if a number is not divisible by 2, 3, 5 or 7, that it is prime. However, this isn't always true. For example, 121 isn't divisible by any of those four values, but $121 = 11 \times 11$, so it isn't prime. Arup pseudoprimes are numbers that ARE NOT prime, but also are not divisible by 2, 3, 5 or 7. Write a program, that, given a range of positive integers, prints out all the integers within the range that are Arup pseudoprimes.

Input and Output Restrictions

Both integers entered will be positive integers less than or equal to 10000. The first integer will be less than or equal to the second integer. The range of numbers described will be inclusive. Hence, if the user enters 119 for the low bound and 121 for the high bound, then your program should consider the integers 119, 120 AND 121. From these, only 121 is an Arup pseudoprime and should be printed. For the output, simply output one Arup pseudoprime per line and list them in numerically increasing order.

Sample Run

```
Enter the low bound for your search of Arup pseudoprimes.
```

```
50
```

```
Enter the high bound for your search of Arup pseudoprimes.
```

```
200
```

```
121
```

```
143
```

```
169
```

```
187
```