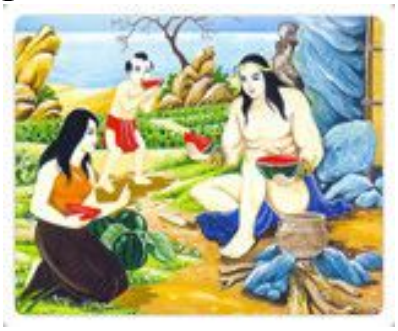
HCMC UNIVERSITY OF TECHNOLOGY, VNU-HCM
Faculty of Computer Science & Engineering



Assignment 2
Mai An Tiem's family on a deserted island
Version 2.0

1. Context introduction

Once upon a time in the kingdom of Hung King, in a rural area far from Phong Chau, there was an orphan boy who often followed the adults to hunt and fish. When he was eight years old, he went to the capital and met Hung King. Seeing the smart boy, the king adopted him and named him Mai An Tiem. Growing up, Mai An Tiem was very healthy and worked hard. Hung King then found a decent wife for him. An Tiem and his wife deforested and cultivated in field in order to support new family life. Shortly thereafter, An Tiem built a house and reaped a lot of grain filled with storage. Seeing that, the envied Hung King said: "An Tiem despised the grace of King. He believed that the wealth he created was due to the grace of God and the energy of his wife and children". Hung King sounded so angry! And no matter what the truth was, the king issued an ordinance forcing the An Tiem's family to a deserted island in the East Sea. Apart from some dried food enough to eat for a few months, the family can not bring any other things. It is to let them see what would happen if they thank only God. So the entire members of An Tiem's family are floating in the sea ...

Finally, the boat reached a deserted island full of white sand. Apart from some dried food as said, An Tiem's family did not have any knife nor seeds with them. An Tiem's wife cried. He comforted his wife: "We have brains and hands so that any difficulty could be overcome!". In the next day, An Tiem found a sharp tree branch. Immediately, he dug the ground deeply and found fresh water to drink. Then he and his children broke the branches and stones to make a shelter for rain and sunshine. His wife went down to the seaside to find crabs and fish. Thanks to earning big flints, An Tiem hit two stones together to make fire to cook crabs and to boil snails.

One day, An Tiem saw a white bird flying over, dropping seeds onto the white sand. Thinking that if a bird would eat something, people could also consume it as food, An Tiem tried to plant the seeds. A few months later, the seeds grew into small trees and An Tiem could harvest the fruits and bring them to his family to eat ...

In this assignment, we have to calculate the viability of the An Tiem family on this deserted island based on the seeds that An Tiem planted.

(Source: http://www.tusachthantien.com)

2. Assignment requirement

In this assignment, students will be provided with a file containing input data, including parameters for the health index of the Mai An Tiem family, information on planting seeds and location of farming land. The program will calculate and print out the screen the probability of survival of Mai An Tiem and her family through the results of cultivation and harvesting of seeds. Students will also be provided with a sample program to read data from the input file and export the results to the screen.

3. Input data

Input of the program is contained in the file named input.txt. This file includes information about three An Tiem's family health index, seed type and cultivation location. This file contains three integers in the following format:

hp d s

where

- ***hp****: health index, an integer value between 1 and 999*
- ***d****: distance from the crop location to the center of the island, an integer value between 1 and 1000.*
- ***s****: seed type , an integer value between 1 and 100*

4. Output data

The program will output directly to the screen the probability value $p(R)$ that predicts the viability of Mai An Tiem's family on the island. The value of $p(R)$ will be calculated by the following formula:

$$p(R) = \frac{P_1 + P_2 \times f(d,s)}{1000 + |P_2 \times f(d,s)|} \qquad (1)$$

If hp is a prime number, then $P1$=1000 and P_2= (hp + s) mod 1000.
Otherwise, P_1 = hp and P_2= (hp + d) mod 100.

Note that according to (1), $p(R)$ may be less than 0 or greater than 1.

In case where $p(R)$ less than 0, the result will be returned as 0; and in case where $p(R)$ greater than 1, the result will be returned as 1.

In addition, the $p(R)$ value should be rounded to contain up to 3 decimal places.

Function $f(d,s)$ is determined based on the specifications below:

a) If d < 200, the center of the island, where many marshes are difficult for seedlings to survive, $f(d,s) = 0$ for any values of s, unless $(d + s)$ is a number of the Fibonacci sequence (for more information about this series, refer to http://en.wikipedia.org/wiki/Fibonacci_number). In this particular case, the seedling will grow like the case *b* as below.

Example 1. In case of input data as

```
67 144 100
```

then the output will be 1 because *hp* is a prime number so P_1=1000; in addition, $d < 200$ and $(d+s)$ are not in the Fibonacci sequence so $f(d,s) = 0$.

Example 2. In case of input data as

```
600 144 100
```

the output will be then 0,6 because *hp* is not a prime number so $P_1 = hp = 600$; in addition, $d < 200$ and $(d + s)$ are not in the Fibonacci sequence, consequently $f(d,s) = 0$.

Example 3. In case of input data as

```
657 84 60
```

the output will be then 0,886, since *hp* is not a prime number, consequently $P_1 = hp = 657$ and $P_2 = 741 \bmod 100 = 41$; beside that, $d < 200$ and $(d+s)$ are in the Fibonacci sequence, hence $f(d,s) = 49.2$ (in order to understand how to calculate $f(d,s)$, refer to case (*b*) below)

b) In case that *d* between 200 and 800, this is a very good farming land. And now, the function $f(d,s)$ is determined by the formula:

$$f(d,s) = 40 - \frac{|d-500|}{20} + g(s) \qquad (2)$$

where $g(s)$ depends on the type of plant variety defined by the value of *s* as follows:

S	Seed type	Property	$g(s)$
s mod 6 = 0	Cittrullus lanatus	is a plant in the Cucurbitaceae family, a hard-shelled, water-rich fruit, native to southern Africa and the most common fruit in the Cucurbitaceae family. Welding watermelon can be used as a cooling food on hot summer days.	*s/2*
s mod 6 =1	Artocarpus	is a species of fruit, growing popular in	2*s*

	hetero-phyll us	Southeast Asia and Brazil. It is a member of the Mulaceae family, and is thought to have originated in India and Bangladesh. Jackfruit is the national fruit of Bangladesh.	
s mode 6 = 2	Datura metel	is a wild tree distributed in many regions of Vietnam. In Eastern medicine, Datura is a medicine. However, due to its high toxicity, people only use it by direction from a doctor. When poisoned with poisonous poisoning, the victim has dilated pupils, blurred vision, heart palpitations, bronchiectasis, dry lips, dry neck that could not swallow and could not speak. The toxin acts on the central nervous system, can be fatal due to coma.	$-(s \bmod 9)^3/5$
s mod 6 = 3	Abrus precatorius	is a plant belonging to the legume family, has leafy leaves like tamarind leaves, fruit-like pods but has beautiful red-black seeds inside, easy to attract the attention of children. However, these seeds contain abrin, a powerful toxin. Some licorice seeds can cause death.	$-(s \bmod 30)^2+3s$
s mod 6 = 4	Strychnos nux-vomica	With a shape very similar to oranges, is a powerful poison. Their seeds are high in alcaloid, a toxin that can cause systemic twitching and paralysis of the respiratory muscles, causing suffocation leading to death. People often use the money code to kill mice, but they also cause many terrible poisonings to people.	-s
s mod 6 = 5	Ricinus communis	to make ornamental as a result of their beautiful shape. Castor seeds contain ricin, a potent toxin. According to scientists, the amount of toxins from 5 to 6 castor seeds can cause a small child to die, 9-10 seeds can kill an adult.	$-T((s \bmod 5)+5)$ where $T(n)$ is a sequence of triangular number

(Reference: http://vnexpress.net/gl/khoa-hoc/anh/2013/01/5-trai-cam-co-the-gay-chet-nguoi-o-viet-nam/)

Note: Students know more about the triangular number, can be found at http://en.wikipedia.org/wiki/Triangular_number.

Example 4. In case of input data as

```
657 400 85
```

$f(d, s)$ is then calculated by the formula $2s$ (since s mod 6 = 1), and the output will be then 0,973.

Example 5. In case of input data as

```
657 400 86
```

$f(d, s)$ is calculated by the formula $-(s \bmod 9)^3/5$ (since s mode 6 = 2), and then the output will be 0,782.

Example 6. In case of input data as

```
657 400 87
```

then $f(d, s)$ is calculated by the formula $-(s \bmod 30)^2+3s$ (since s mode 6 = 3), and hence the output will be 0.

Example 7. In case of input data as

```
657 400 35
```

thì $f(d, s)$ is calculated by the formula $-T((s \bmod 5)+5)$ where $T(n)$ is a sequence of triangular number (since s mode 6 = 5), and hence, the output will be 0.84.

c) However, in case where d in the range of 200 to 300, this area has many iridescent snakes and the probability of being bitten by snakes is quite high. The probability of being bitten is calculated by $(d+ P_1 + P_2) / 1000$. If this probability is greater than 0.8, it means that the death will come to An Tiem's family and the result must be 0.

Example 8. In case of input data as

```
657 250 100
```

then the output will be 0 since hp is not a prime number so $P_1=hp=657$ and $P_2 = 907 \bmod 100 = 7$; beside that, do d in the range of 200 and 300, The probability of being bitten from snakes will be 0.914 > 0.8, the death will come to An Tiem's family.

d) If $d > 800$, this position is near the coast of the salt water so the seed will not produce good fruit, then

$$f(d,s) = -d*s/1000.$$

Example 9. In case of input data as

```
657 844 100
```

then the output will be 0,528 since *hp* is not a prime number so $P_1 = hp = 657$ and $P_2 = 1501 \bmod 100 = 1$; beside that, $d > 800$ and consequently, $f(d,s) = 84.4$.

Note:
Students cannot round intermediate results, which can lead to errors in the final result. In addition, in C/C++, the division of two integer variables returns an integer result. That means the numbers after the decimal point in the calculation result are automatically discarded. For example:

```
1:    float a1 = 17;
2:    int a2 = 17;
3:    float r1 = a1/16;
4:    float r2 = a2/16;
5:    cout <<"r1 = "<< r1 <<"; r2 = " << r2;
```

The output to the screen will be: "r1 = 1.0625; r2 = 1".

Proposed solution:
When performing division by two integers and having the result returned as a real number, casting is required before performing the division, for example, if you replace the line (4) above with the line (4') as shown below:

```
4':   r2 = ((float) a2)/8 ;
```

The output to the screen after executing line (5) will be: "r1 = 1.0625; r2 = 1.0625".

If you want to round 3 decimal places, the (4) line needs to correct as:

```
4':   r2 = ((float) a2)/8 ;
5':   r2 = round(r2 * 1000) / 1000;
```

The output to the screen after executing line (5) will be: "r1 = 1.0625; r2 = 1. 063".

5. Initialization

Students download *assigment2.zip* from the course's Web site. When extracting this file, you will get the following files:

`input.txt`	An example input file.
`antiem.cpp`	Initialization program
`Assignment2.pdf`	Assignment description

In addition to the three libraries already used in *antiem.cpp*, students may NOT use any other libraries. When submitting the result, students must use the account in BKeL. Students only submit one file *antiem.cpp*. The file submitted must be the original program file, BUT NOT A COMPRESSED FILE (ZIP) WHEN SUBMITTING. **Students must check their program on Cygwin before submitting.**

6. Submission

The deadline for submission is **13:00 on Monday, November 18th, 2019**. Students must use the account on the BKeL system to submit your work. We DO NOT accept any thing related to assignment which is sent via email or any other form. Late submissions will NOT be accepted.

7. Plagiarism checking

The assignment must be DONE by yourself. Students will be considered cheating if:

- There is an unusual similarity between the source code of the submissions. In this case, ALL submissions are considered fraud. Therefore you must protect the source code of yourself.
- Students do not understand the source code written by themselves, except the initialized code. Students can refer to any resource, but make sure that you understand the meaning of all the commands you write. In case of not understanding the source code of the place where you refer, students are specifically warned that they **should NOT** use this source code. Instead, use what you have learned to write the program.

After each assignment is submitted, there will be a number of students who are randomly interviewed to prove that the assignment has been submitted by themselves.

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In the case of cheating conclusion, student score should be **0** for the entire course (not just only this assignment). **WE DO NOT ACCEPT ANY EXPLANATION AND NO EXCEPTIONS!**