Spring, 2015 CIT 590

Programming Languages and Techniques

Homework 1

All HW deadlines as per canvas

This homework deals with the following topics

* using the IDLE

* getting started with Python - variables, loops and functions

* working your way through specifications

General idea .

Hammurabi is a very old computer game, in which you are the ruler of ancient Samaria, trying to increase the wealth of your country. Your job is to bring this program into the 21st century by writing it in Python.

To get an idea of this game, I strongly recommend you play the online version for a while. Click on link below.

hammurabi.

The step by step instructions are provided on subsequent pages. Write all your code in a file called Hammurabi.py and submit that one single file on canvas.

We provide step by step instructions. Follow along and please ask questions if you have issues.

Do not worry about non-integer inputs in this assignment. We will talk about error checking later in this course. This is meant to be an easier assignment to get you started with programming and the TAs will be 'nice'.

Since this is your very first program we will guide you a fair bit. Here are the steps

1. Write and test a print statement to print out the following introductory message:

   Congrats, you are the newest ruler of ancient Samaria, elected for a ten year term of office. Your duties are to distribute food, direct farming, and buy and sell land as needed to support your people. Watch out for rat infestations and the resultant plague! Grain is the general currency, measured in bushels. The following will help you in your decisions:

   * Each person needs at least 20 bushels of grain per year to survive.
   * Each person can farm at most 10 acres of land.
   * It takes 2 bushels of grain to farm an acre of land.
   * The market price for land fluctuates yearly.

   Rule wisely and you will be showered with appreciation at the end of your term. Rule poorly and you will be kicked out of office!

   All of that text can be placed into a single print statement by using a triply quoted string.

2. Put the print statement from above into a function called **print_intro()**. Test this out by calling the function in the REPL (the IDLE prompt)

3. Write a function called **Hammurabi()**. Inside this function put a call to print_intro. Test your Hammurabi function.

4. Declare the following variables, which you will need in the rest of the program. Put them as the first thing inside your Hammurabi function, before the call to print_intro.

```
starved = 0
immigrants = 5
population = 100
harvest = 3000          # total bushels harvested
bushels_per_acre = 3    # amount harvested for each acre planted
rats_ate = 200          # bushels destroyed by rats
bushels_in_storage = 2800
acres_owned = 1000
cost_per_acre = 19      # each acre costs this many bushels
plague_deaths = 0
```

5. Next inside **Hammurabi**, write a loop to print the following report ten times, with the variable year set to 1, 2, 3, ..., 10. Each of the numbers in red in the report should be the value of the corresponding variable.

O great Hammurabi!

You are in year 1 of your ten year rule.

In the previous year 0 people starved to death.

In the previous year 5 people entered the kingdom.

The population is now 100.

We harvested 3000 bushels at 3 bushels per acre.

Rats destroyed 200 bushels, leaving 2800 bushels in storage.

The city owns 1000 acres of land.

Land is currently worth 19 bushels per acre.

There were 0 deaths from the plague.

That's it for most of the printing. Next, inside the "year loop," you will ask the user for input.

6. Use functions to ask the Great Hammurabi (the user) to make some decisions. Check each decision to see whether it is possible (give enough parameters to the function to be able to decide this). If it is not possible, ask the Great Hammurabi very, very politely (as befits his high status) for a different answer, and repeat if necessary until a legal answer is obtained.

   At the beginning of each year, ask the player for

   - How many acres of land to buy
   - How many acres of land to sell (do not ask this if land is being bought)
   - How much grain to feed the people
   - How many acres to plant with seed

   Questions should be asked in this order, and the player does not get a chance to go back and change an earlier answer. A player who is buying land is not allowed to sell land during the same turn; so if the user asks to buy land, do not call the function that asks how much land to sell.

   As an example, the first function has been written for you. Pay particular attention to the manner in which we have commented the function. You will be required to document each of your functions in that manner (triply - quoted string).

```
def ask_to_buy_land(bushels, cost):
    '''Ask user how many bushels to spend buying land.'''
```

```
    acres = input("How many acres will you buy? ")
    while acres * cost > bushels:
        print "O great Hammurabi, we have but", bushels, "bushels of grain!"
        acres = input("How many acres will you buy? ")
    return acres

def ask_to_sell_land(acres):
    '''Ask user how much land they want to sell. '''

def ask_to_feed(bushels):
    '''Ask user how many bushels they want to use for feeding. '''

def ask_to_cultivate(acres, population, bushels):
    '''Ask user how much land they want to plant seed in '''
```

Each function should be given just enough information to test whether the user's answer is legal, and to return that legal answer. That answer should then be used (within the hammurabi function) to adjust the values of the variables declared in #4 above. Don't forget to test every function you write!

7. After you collect the answers to the above questions, you need to determine the consequences, in the order specified below. Again, for each of the following, call an appropriately-named function, and use the number returned by the function to update the variables in the **hammurabi** function. Test each function as you go.

   Many of the functions use random numbers. Here is how you get random numbers. To get a random number generator, you first need to **import random**. Do this by writing that line once, at the top of your program. To get a new random number in the range a to b, including both endpoints, call **random.randint(a, b)**.

   Here are the functions that you have to write

   - If there is a plague

     call this function **isPlague()**.

     Each year, there is a 15% chance of a horrible plague. When this happens, half your people die. This function should return a boolean. 15% of the time it returns True and 85% of the time it returns False.

   - How many people starved

     call this function **numStarving(population, bushels)**.

     It returns an integer that gives you the number of people that starved. Each person needs 20 bushels of grain to survive. If you feed them more than this, the grain has been wasted. If more than 45% of the people starve, you will be

immediately thrown out of office (in this case, you should print a suitably nasty message), and the game ends.

- How many people came to the city

  call this function **numImmigrants(land, grainInStorage, population, numStarving)**.

  If people are starving, no one comes to the city. If everyone is well fed, the number of immigrants is calculated by this simple formula

$$\frac{(20 \times \text{number of acres} + \text{amount of grain in storage})}{(100 \times \text{population}) + 1}$$

- How good the harvest is.

  Call this function **getHarvest().**

  This function returns a random number between 1 and 8, inclusive. Each acre that was planted with seed will yield this many bushels of grain. (Example: if you planted 50 acres, and the random number is 3, you harvest 150 bushels of grain)

- Whether or not rats ruin things.

  Call this function **doRatsInfest()**. It returns a number between 0.1 and 0.3.

  Every year there is a 40% chance of rat infestation. When this happens between 10 to 30 percent of your grain gets destroyed.

- How much land costs next year.

  Call this function **priceOfLand().**

  The price of land is random and ranges from 16 to 22 bushels per acre. The player will need to know this information in order to buy or sell land.

8. At the end of the game (inside the Hammurabi function but outside the year loop), use a function to print out a final summary, and to tell the player how good a job he/she did. I will leave the details up to you, but the usual evaluation is based on how many people starved, and how many acres you end up with.

9. Run your program and make sure it works. Be a good ruler! One good idea is to show off your program to someone who is not familiar with computer programming. If your program is well written, they will have fun playing it. If not, you can use their feedback to improve your user interaction.