CS 171 - Programming Assignment 3

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February 2, 2018

1 Overview

There were many computer games developed in the 1970s that allowed players to simulate the moon landing. The goal was to pilot the lunar lander to a safe landing. In this homework, you will make a version of this game.

Contents

2 Lunar Lander Simulation

The Lunar Lander Simulation has a number of initial values.

$G = -1.622$	Pull of Gravity (m/s^2)
A =50	Altitude (m)
V =0	Initial Velocity (m/s)
F =150	Units of Fuel
s =0	Number of Seconds passed.

The Lander starts 50 meters above the lunar surface. It starts with no initial velocity. The lander has 150 units of fuel it can use to slow it's descent. The moon pulls the lander down at -1.622 m/s^2.

The game will simulate time in 1 second steps. At each second, the player will be asked how many units of fuel to burn. Burning fuel slows down the lander's descent by $0.1m/s^2$.

T =0.1	Thruster Acceleration (m/s^2)

A single second of simulation requires five calculations, performed in the following order.

f =Ask Player	Fuel to Burn
$F = F - f$	Remove Fuel from tank
$V = V + G + T * f$	Update Velocity
$A = A + V$	Update Altitude
$s = s + 1$	Record that a second passed

The simulation should continue until the altitude is 0 or less. When the altitude reaches 0, that means the lander has landed. For the landing to be safe, the speed must be between $-2m/s$ and $2m/s$. If the landing is outside this range, then the lander will be destroyed when it lands.

3 Programming Project

You are required to make 2 functions in this homework. You may create and use additional functions, but you **must** create these two.

3.1 Ask for Fuel

Create a function `def ask_fuel(current_fuel)` that gets the amount of fuel from the user. The amount of fuel entered is only valid if it meets certain

requirements. Repeatedly ask the player for an input until they give you a valid amount.

The fuel to burn must meet the following requirements:

- Is an integer amount. The lander cannot burn decimal amounts.
- Is a positive number. The lander cannot burn negative fuel.
- Is less than or equal to the remaining fuel. The lander cannot burn more fuel then it has.

3.2 Play Level

Create a function `def play_level(name,G,fuel)` that allows the player to land on a planet. For the moon, this function would be called `play_level(''Moon'',-1.622,150)`.

The function should print an introduction with all the information about the current level.

For example,

```
Landing on the Moon
Gravity is -1.62 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 150 units
```

GO

The simulation should then run until the player either dies in a horrible crash or lands safely.

```
After 1 seconds Altitude is 48.38 meters, velocity is -1.62 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
15
After 2 seconds Altitude is 46.63 meters, velocity is -1.74 m/s.
Remaining Fuel: 135 units.
Enter units of fuel to use:
0
```

The altitude should never print a negative number. The lander stops at altitude 0. It is either safe or a wreck, but it cannot be at a negative altitude. If the lander was going to fast to land print.

```
Crashed!
```

If the lander was at a slow speed then

```
Landed Successfully.
```

3.3 Main Program Body

Your python file should be named lander.py.

The game will have 11 levels. The user can only progress to the next level my landing safely in the current level. If the player dies, they may replay the level. Between levels, give the user the option to quit the game.

The first level **must** be the moon. You may decide on any order and fuel restrictions for the other planets. The moon **must** start with 150 units of fuel.

The Gravity levels and fuel levels for the other planets are given in the below table.

Planet	**Gravity**	Fuel
Moon	-1.622	150
Earth	-9.81	5000
Pluto	-0.42	1000
Neptune	-14.07	1000
Uranus	-10.67	1000
Saturn	-11.08	1000
Jupiter	-25.95	1000
Mars	-3.77	1000
Venus	-8.87	1000
Mercury	-3.59	1000
Sun	-274.13	50000

4 Example Execution Trace

You are not required to exactly match the below layout, but your content must be the same.

4.1 Example 1

```
Welcome to Lunar Lander Game.
Do you want to play level 1? (yes/no)
yes
Entering Level 1
Landing on the Moon
Gravity is -1.62 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 150 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 48.38 meters, velocity is -1.62 m/s.
```

```
Remaining Fuel: 150 units.
Enter units of fuel to use:
15
After 2 seconds Altitude is 46.63 meters, velocity is -1.74 m/s.
Remaining Fuel: 135 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 43.27 meters, velocity is -3.37 m/s.
Remaining Fuel: 135 units.
Enter units of fuel to use:
15
After 4 seconds Altitude is 39.78 meters, velocity is -3.49 m/s.
Remaining Fuel: 120 units.
Enter units of fuel to use:
0
After 5 seconds Altitude is 34.67 meters, velocity is -5.11 m/s.
Remaining Fuel: 120 units.
Enter units of fuel to use:
50
After 6 seconds Altitude is 32.94 meters, velocity is -1.73 m/s.
Remaining Fuel: 70 units.
Enter units of fuel to use:
0
After 7 seconds Altitude is 29.58 meters, velocity is -3.35 m/s.
Remaining Fuel: 70 units.
Enter units of fuel to use:
50
After 8 seconds Altitude is 29.61 meters, velocity is 0.02 m/s.
Remaining Fuel: 20 units.
Enter units of fuel to use:
0
After 9 seconds Altitude is 28.01 meters, velocity is -1.60 m/s.
Remaining Fuel: 20 units.
Enter units of fuel to use:
20
After 10 seconds Altitude is 26.79 meters, velocity is -1.22 m/s.
Remaining Fuel: 0 units.
Enter units of fuel to use:
0
After 11 seconds Altitude is 23.95 meters, velocity is -2.84 m/s.
Remaining Fuel: 0 units.
Enter units of fuel to use:
0
After 12 seconds Altitude is 19.48 meters, velocity is -4.46 m/s.
Remaining Fuel: 0 units.
Enter units of fuel to use:
```

```
0
After 13 seconds Altitude is 13.40 meters, velocity is -6.09 m/s.
Remaining Fuel: 0 units.
Enter units of fuel to use:
0
After 14 seconds Altitude is 5.69 meters, velocity is -7.71 m/s.
Remaining Fuel: 0 units.
Enter units of fuel to use:
0
After 15 seconds Altitude is 0.00 meters, velocity is -9.33 m/s.
Remaining Fuel: 0 units.
Crashed!
Do you want to play level 1? (yes/no)
no
You made to past 0 levels.
Thanks you Playing.
```

4.2 Example 2

```
Welcome to Lunar Lander Game.
Do you want to play level 1? (yes/no)
yes
Entering Level 1
Landing on the Moon
Gravity is -1.62 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 150 units

GO
Enter units of fuel to use:
bad
Please Enter Integer Value.
Enter units of fuel to use:
input
Please Enter Integer Value.
Enter units of fuel to use:
-90
Cannot use neagtive fuel.
Enter units of fuel to use:
200
No enough fuel. Max Fuel: 150
Enter units of fuel to use:
0
After 1 seconds Altitude is 48.38 meters, velocity is -1.62 m/s.
```

```
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 45.13 meters, velocity is -3.24 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 40.27 meters, velocity is -4.87 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 4 seconds Altitude is 33.78 meters, velocity is -6.49 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 5 seconds Altitude is 25.67 meters, velocity is -8.11 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 6 seconds Altitude is 15.94 meters, velocity is -9.73 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 7 seconds Altitude is 4.58 meters, velocity is -11.35 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
100
After 8 seconds Altitude is 1.61 meters, velocity is -2.98 m/s.
Remaining Fuel: 50 units.
Enter units of fuel to use:
30
After 9 seconds Altitude is 0.01 meters, velocity is -1.60 m/s.
Remaining Fuel: 20 units.
Enter units of fuel to use:
20
After 10 seconds Altitude is 0.00 meters, velocity is -1.22 m/s.
Remaining Fuel: 0 units.
Landed Successfully.
Do you want to play level 2? (yes/no)
yes
Entering Level 2
Landing on the Earth
Gravity is -9.81 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
```

```
Initial Fuel Level: 5000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 40.19 meters, velocity is -9.81 m/s.
Remaining Fuel: 5000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 20.57 meters, velocity is -19.62 m/s.
Remaining Fuel: 5000 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 0.00 meters, velocity is -29.43 m/s.
Remaining Fuel: 5000 units.
Crashed!
Do you want to play level 2? (yes/no)
no
You made it past 1 levels.
Thanks you Playing.
```

5 Grading

There are no strict guidelines for how to write your code or develop your user interface. You will be graded on the quality of your design and execution.

- Levels (22 points)
  - 2 points for each level having fuel and gravity.
- Ask Fuel Correct (20 points)
- Play Level Correct (20 points)
- Main Problem (25 points)
- User can only progress by beating level (3 points)
- User Interface easy to read/understand (4 points)
- File is well commented (3 points)
- Name in Comments (1 point)
- Section Number in Comments (1 point)
- File named correctly (1 point)

If you code has any runtime errors, a 50 point deduction will be taken. Only portions of the code that execute without errors will be graded.

6 Resources

Additional Resources

https://en.wikipedia.org/wiki/Lunar_Lander_(1979_video_game)
http://www.aerospaceweb.org/question/astronomy/q0227.shtml
http://moonlander.seb.ly

7 Perfect Run

```
Welcome to Lunar Lander Game.
Do you want to play level 1? (yes/no)
Entering Level 1
Landing on the Moon
Gravity is -1.62 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 150 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 48.38 meters, velocity is -1.62 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 45.13 meters, velocity is -3.24 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 40.27 meters, velocity is -4.87 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 4 seconds Altitude is 33.78 meters, velocity is -6.49 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 5 seconds Altitude is 25.67 meters, velocity is -8.11 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
0
After 6 seconds Altitude is 15.94 meters, velocity is -9.73 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
```

```
0
After 7 seconds Altitude is 4.58 meters, velocity is -11.35 m/s.
Remaining Fuel: 150 units.
Enter units of fuel to use:
84
After 8 seconds Altitude is 0.01 meters, velocity is -4.58 m/s.
Remaining Fuel: 66 units.
Enter units of fuel to use:
61
After 9 seconds Altitude is 0.00 meters, velocity is -0.10 m/s.
Remaining Fuel: 5 units.
Landed Successfully.
Do you want to play level 2? (yes/no)
yes
Entering Level 2
Landing on the Earth
Gravity is -9.81 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 5000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 40.19 meters, velocity is -9.81 m/s.
Remaining Fuel: 5000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 20.57 meters, velocity is -19.62 m/s.
Remaining Fuel: 5000 units.
Enter units of fuel to use:
89
After 3 seconds Altitude is 0.04 meters, velocity is -20.53 m/s.
Remaining Fuel: 4911 units.
Enter units of fuel to use:
300
After 4 seconds Altitude is 0.00 meters, velocity is -0.34 m/s.
Remaining Fuel: 4611 units.
Landed Successfully.
Do you want to play level 3? (yes/no)
yes
Entering Level 3
Landing on the Pluto
Gravity is -0.42 m/s^2
Initial Altitude: 50 meters
```

```
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 49.58 meters, velocity is -0.42 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 48.74 meters, velocity is -0.84 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 47.48 meters, velocity is -1.26 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 4 seconds Altitude is 45.80 meters, velocity is -1.68 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 5 seconds Altitude is 43.70 meters, velocity is -2.10 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 6 seconds Altitude is 41.18 meters, velocity is -2.52 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 7 seconds Altitude is 38.24 meters, velocity is -2.94 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 8 seconds Altitude is 34.88 meters, velocity is -3.36 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 9 seconds Altitude is 31.10 meters, velocity is -3.78 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 10 seconds Altitude is 26.90 meters, velocity is -4.20 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
```

```
0
After 11 seconds Altitude is 22.28 meters, velocity is -4.62 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 12 seconds Altitude is 17.24 meters, velocity is -5.04 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 13 seconds Altitude is 11.78 meters, velocity is -5.46 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 14 seconds Altitude is 5.90 meters, velocity is -5.88 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
5
After 15 seconds Altitude is 0.10 meters, velocity is -5.80 m/s.
Remaining Fuel: 995 units.
Enter units of fuel to use:
60
After 16 seconds Altitude is 0.00 meters, velocity is -0.22 m/s.
Remaining Fuel: 935 units.
Landed Successfully.
Do you want to play level 4? (yes/no)
yes
Entering Level 4
Landing on the Neptune
Gravity is -14.07 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 35.93 meters, velocity is -14.07 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 7.79 meters, velocity is -28.14 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
345
After 3 seconds Altitude is 0.08 meters, velocity is -7.71 m/s.
```

```
Remaining Fuel: 655 units.
Enter units of fuel to use:
217
After 4 seconds Altitude is 0.00 meters, velocity is -0.08 m/s.
Remaining Fuel: 438 units.
Landed Successfully.
Do you want to play level 5? (yes/no)
yes
Entering Level 5
Landing on the Uranus
Gravity is -10.67 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 39.33 meters, velocity is -10.67 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 17.99 meters, velocity is -21.34 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
141
After 3 seconds Altitude is 0.08 meters, velocity is -17.91 m/s.
Remaining Fuel: 859 units.
Enter units of fuel to use:
284
After 4 seconds Altitude is 0.00 meters, velocity is -0.18 m/s.
Remaining Fuel: 575 units.
Landed Successfully.
Do you want to play level 6? (yes/no)
yes
Entering Level 6
Landing on the Saturn
Gravity is -11.08 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
```

```
0
After 1 seconds Altitude is 38.92 meters, velocity is -11.08 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 16.76 meters, velocity is -22.16 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
165
After 3 seconds Altitude is 0.02 meters, velocity is -16.74 m/s.
Remaining Fuel: 835 units.
Enter units of fuel to use:
277
After 4 seconds Altitude is 0.00 meters, velocity is -0.12 m/s.
Remaining Fuel: 558 units.
Landed Successfully.
Do you want to play level 7? (yes/no)
yes
Entering Level 7
Landing on the Jupiter
Gravity is -25.95 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 24.05 meters, velocity is -25.95 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
280
After 2 seconds Altitude is 0.15 meters, velocity is -23.90 m/s.
Remaining Fuel: 720 units.
Enter units of fuel to use:
495
After 3 seconds Altitude is 0.00 meters, velocity is -0.35 m/s.
Remaining Fuel: 225 units.
Landed Successfully.
Do you want to play level 8? (yes/no)
yes
Entering Level 8
Landing on the Mars
Gravity is -3.77 m/s^2
Initial Altitude: 50 meters
```

```
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 46.23 meters, velocity is -3.77 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 38.69 meters, velocity is -7.54 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 27.38 meters, velocity is -11.31 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 4 seconds Altitude is 12.30 meters, velocity is -15.08 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
66
After 5 seconds Altitude is 0.05 meters, velocity is -12.25 m/s.
Remaining Fuel: 934 units.
Enter units of fuel to use:
159
After 6 seconds Altitude is 0.00 meters, velocity is -0.12 m/s.
Remaining Fuel: 775 units.
Landed Successfully.
Do you want to play level 9? (yes/no)
yes
Entering Level 9
Landing on the Venus
Gravity is -8.87 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 41.13 meters, velocity is -8.87 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
```

```
0
After 2 seconds Altitude is 23.39 meters, velocity is -17.74 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
33
After 3 seconds Altitude is 0.08 meters, velocity is -23.31 m/s.
Remaining Fuel: 967 units.
Enter units of fuel to use:
320
After 4 seconds Altitude is 0.00 meters, velocity is -0.18 m/s.
Remaining Fuel: 647 units.
Landed Successfully.
Do you want to play level 10? (yes/no)
yes
Entering Level 10
Landing on the Mercury
Gravity is -3.59 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 1000 units

GO
Enter units of fuel to use:
0
After 1 seconds Altitude is 46.41 meters, velocity is -3.59 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 2 seconds Altitude is 39.23 meters, velocity is -7.18 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 3 seconds Altitude is 28.46 meters, velocity is -10.77 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
0
After 4 seconds Altitude is 14.10 meters, velocity is -14.36 m/s.
Remaining Fuel: 1000 units.
Enter units of fuel to use:
39
After 5 seconds Altitude is 0.05 meters, velocity is -14.05 m/s.
Remaining Fuel: 961 units.
Enter units of fuel to use:
175
After 6 seconds Altitude is 0.00 meters, velocity is -0.14 m/s.
```

```
Remaining Fuel: 786 units.
Landed Successfully.
Do you want to play level 11? (yes/no)
yes
Entering Level 11
Landing on the Sun
Gravity is -274.13 m/s^2
Initial Altitude: 50 meters
Initial Velocity: 0.00 m/s
Burning a unit of fuel causes 0.10 m/s slowdown.
Initial Fuel Level: 50000 units

GO
Enter units of fuel to use:
2242
After 1 seconds Altitude is 0.07 meters, velocity is -49.93 m/s.
Remaining Fuel: 47758 units.
Enter units of fuel to use:
3239
After 2 seconds Altitude is 0.00 meters, velocity is -0.16 m/s.
Remaining Fuel: 44519 units.
Landed Successfully.
```