

1.1 Introduction

The purpose of this problem is to write a script which will take user input, the day, month, and year, and print out information on the phase of the moon at that given date. The data returned to the user is percent illumination, date, and whether the moon is becoming brighter or not at that particular date. Sample output and a brief overview of the models and methods is given in this report and a brief discussion is done finally to review the results of the program output.

1.2 Models and Methods

Phase of the moon is calculated by using a fully enumerated date and plugging the data into an empirical based equation which uses the data to output a normalized value for the illumination of the moon. A key component of the data which needs to be computed after user input is validated is a number called the *Julian Day Number*. Below are the relevant equations used for the julian day calculations.

3 B.C.

$$J = \text{day} + \left\lfloor \frac{153m + 2}{5} \right\rfloor + 365y + \left\lfloor \frac{y}{4} \right\rfloor - \left\lfloor \frac{y}{100} \right\rfloor + \left\lfloor \frac{y}{400} \right\rfloor - 32045$$

$$y = \text{year} - a + 4800$$

$$m = \text{month} + 12a - 3$$

Once this number is calculated it can be used in the primary calculation for the illumination of the moon at this particular time. The following equation is used to do this.

$$L = \sin \left(\pi \frac{(\Delta J \bmod T)}{T} \right)^2$$

After all the relevant data is collected and the value for illumination is calculated, a second calculation to find the rate of change of the illumination is performed. This is done by adding a J' data point with day = day + 1. This new J' is used to calculate a second illumination. By taking L' - L we can see whether the illumination is waxing or waning. For delta L positive, the moon is waxing, else the moon is waning. The data is then formatted for printing by the command fprintf, which concludes the program.

1.3 Calculations and Results

The following is an example of a valid input and result of the code.

```
please enter the month as MMM (e.g. JAN):JAN
please enter the day as DD (e.g. 01):01
please enter the year as YYYY (e.g. 2000):2001
```

```
JAN 01 2001:
Illumination = 38.5 percent
Waxing
```

Next is an example of some invalid input

```
please enter the month as MMM (e.g. JAN):jan
please enter the day as DD (e.g. 01):1
Error using hw2_204669893_p1 (line 27)
user must input the day as DD:
```

1.4 Discussion

According to this program the next full moon will be on april 30th. One of the assumptions this program makes is that the person using it will be in a particular location where the results will be valid. A future improvement would be to make a feature that can modify the output to fit for any location that the user specifies.