

## Homework #9

*Due: Wednesday, April 25, 2018, 23.59.*

### Formatted output & structures: Stars and their planets

MAT files are used for saving MATLAB variables for later use, or for transferring them between computers. You can save your variables into a MAT file by giving the **save** command. Example:

```
>> save('myvariables.mat');
```

In order to save specific variables (rather than all), you can list the variables to be saved by providing their names in quotations after the file name. Example for saving two variables p and q:

```
>> save('myvariables.mat','p','q');
```

The contents of MAT files are retrieved into MATLAB workspace by making use of the **load** command. Example:

```
>> fileName= 'stars.mat';  
>> load(fileName);
```

The MAT file **hw09Stars.mat** contains a cell array matrix variable named **ValuableStars** that keeps information about various stars and their planets.

This cell array matrix contains three columns. Every row is allocated to a different star; as more stars can be added to this database in time, assume the number of rows is not fixed. In every row, the first column is the star's name and the second column is its distance to Earth in light years (assume 1 light year = 9,500,000,000,000 km). The third column contains information about the star's planets. This information is in the form of an embedded (inner) cell array of four columns.

The embedded cell arrays have the following structure: The first column contains the planet name; the second column is the distance to its star in kilometers; the third column is its diameter in kilometers; the fourth column is its water ratio. Every star

may have a different number of planets; therefore the number of rows of the inner cell array is not fixed.

The below schema shows the structure of a row in the **ValuableStars** cell array:

Star name	Distance to Earth	Planet name	Distance to its star	Diameter	Water ratio
		Planet name	Distance to its star	Diameter	Water ratio
		Planet name	Distance to its star	Diameter	Water ratio

Write a MATLAB program that does the following jobs:

- Reads the cell array from the **hw09Stars.mat** file.
- Copies the cell array's content into a record structure array variable which has the following fields:
  - starName
  - distanceToEarth
  - planet.planetName
  - planet.distanceToStar
  - planet.diameter
  - planet.waterRatio

Note that as there are possibly many planets of each star, the field **planet** needs to be an array itself!

- Gets the name of a star (or a part of it) from the user. Then, finds all the stars whose names contain that string. For example, in the given file, the substring "**meda**" matches "Andromedae A" and the substring "**is**" matches "54 Piscium" and "61 Virginis".
- Prints the information about the planets of the matching star(s) in a tabular form **exactly** as in the sample format. *Hint: In order to print the '%' character use '%%'.*
- Scans all planets of all stars in the record structure array and finds the one with the highest water ratio, excluding Earth. Displays this information **exactly** as in the sample format.

Output of the program should look **exactly** as below for the given input:

```
Enter star name (or a part of it):  un

Star          Star to Earth  Planet          Star to planet  Diameter  Water %
=====
Sun           1.49598e+08km  Mercury        5.79000e+07km   4878km    0.0000006%
Sun           1.49598e+08km  Venus          1.08284e+08km   12104km   0.0000015%
Sun           1.49598e+08km  Earth          1.49598e+08km   12756km   0.0212300%
Sun           1.49598e+08km  Mars           2.27938e+08km   6787km    0.0002800%
Sun           1.49598e+08km  Jupiter        7.78300e+08km   142796km  0.0000006%
Sun           1.49598e+08km  Saturn         1.42700e+09km   120660km  0.0000016%
Sun           1.49598e+08km  Uranus         2.87100e+09km   51118km   0.0000002%
Sun           1.49598e+08km  Neptune        4.49710e+09km   48600km   0.0000000%

The planet with maximum water ratio is Mars of the star Sun.
It has a water ratio of 0.00028% and a diameter of 6787km.

>>
```

```
Enter star name (or a part of it):  is

Star          Star to Earth  Planet          Star to planet  Diameter  Water %
=====
54 Piscium    3.42950e+14km  54 Piscium b    7.58358e+05km   272134km  0.0000019%
61 Virginis   2.65050e+14km  61 Virginis b   7.50996e+06km   8587km    0.0000014%
61 Virginis   2.65050e+14km  61 Virginis c   1.90280e+07km   4287km    0.0000000%
61 Virginis   2.65050e+14km  61 Virginis d   4.78009e+06km   18934km   0.0000001%

The planet with maximum water ratio is Mars of the star Sun.
It has a water ratio of 0.00028% and a diameter of 6787km.

>>
```

***Make your program as structured as possible. Apply proper indentations. Never use BREAK, CONTINUE or RETURN.***

Name your MatLab m-file as h09yourlastname.m and then upload it to Blackboard Learn at <http://ku.blackboard.com>. Anyone e-mailing his/her homework will lose points!

***While doing all your homework assignments, remember that:***

- *You should not work together,*
- *You should not give or take any files,*
- *You should not give or take help other than simple verbal hints.*