Assignment 7: Matlab Input/ Output and Functions

Date Due: April 4, 2022   Instructor: Trani

Problem 1

Table 1 contains all dams in the United States. The table is taken from a file called US_dams_clean.xlsx included as part of the assignment.

Table 1. United States Dams. Source: National Transportation Atlas (2020). The Second View of this Figure Shows the Nomenclature of the Data Tab.

	Name	DamID	Longitude	Latitude	County	Height	Max Storae	Normal Storage	Surface Area	Drain Area	Hazard	State	Year
2	BRONCE	PR00027	-66.5616	18.0173	PONCE	52	843	620	0	0	S	PR	1939
3	COAMO	PR00016	-66.3844	18.0179	COAMO	65	1280	0	145	66	H	PR	1914
4	PATILLAS	PR00023	-66.021	18.021	PATILLAS	147	13797	11029	367	25	H	PR	1914
5	LOCO	PR00004	-66.8863	18.0446	YAUCO	74	2059	1039	69	8	H	PR	1951
6	ANA MARIA 5	PR00031	-66.5616	18.0583	PONCE	53	2382	1927	79	0	H	PR	1939
7	PORTUGUES	PR82202	-66.635	18.07	NONE	274	32000	16841	230	10	H	PR	9999
8	CARITE	PR00021	-66.1066	18.0782	GUAYAMA	104	14992	8953	333	8	H	PR	1913
9	ANTONIO LUCCHETTI	PR00003	-66.865	18.0831	YAUCO	175	17595	11575	266	17	H	PR	1952
10	GUAYABAL	PR00013	-66.5033	18.0888	JUANA DIAZ	130	5933	4768	373	21	H	PR	1913
11	TOA VACA DAM	PR00014	-66.485	18.1033	VILLALBA	215	54875	50620	836	22	H	PR	1972

Name	Name of dam
DamID	ID
Longitude	degrees (decimal)
Latitude	degrees (decimal)
County	US county
Height	feet
Max Storage	acre-feet
Normal Storage	acre-feet
Surface Area	acres
Drain Area	square miles
Hazard	
L	Low - no probable loss of human life and low economic and/or environmental loss
S	Significant - no probable loss of human life but can cause economic loss, environmental damage
H	High - failure or misoperation will probably cause loss of human life
U	Unknown - he potential hazard is unknown
State	US state
Year	Year built. 9999 means unknown.

Task 1

Use the Matlab import function and create an automatic script to read the data. The script should include renaming variables according to the names shown in the header of the Excel file.

Task 2

Modify the Matlab script created in Task 1 to find the dams that pose a Significant Hazard level. In your script create a new variable that contains the names of the dams found. In your solution display (i.e., include a screen capture) the names of the first 20 dams found in this group in the command window.

Find the mean Drain Area for dams with Significant hazard level. Write the answer to the command window using the **"disp"** command in Matlab.

Task 3

Add another section of code to your Matlab script created in Task 2 to create a histogram of the number of dams constructed over time.Use 30 bins to construct your histogram.

Task 4

Add more code to the script created in Tasks 2 and 3 to find the dams with height greater than 100 feet. Create a variable that contains the names of the dams and count the number of dams in this group. Find the average height of the dams found. In your solution display (i.e., include screen capture) the names of the first 10 dams found, in the command window so that we know which structures were produced by your code.

Task 5

Add a section of code to the Matlab script to plot: 1) a scattered plot with the dam height in the x axis and the maximum storage in the y axis. Comment on the trends observed.

Problem 2

Designing airport runways is a task for Civil Engineers. A file with more than forty thousand landings at LaGuardia International Airport in New York is provided for this analysis. A brief sample of the data is shown below.

	A	B	C	D	E	F	G	H
1	Airport	Flight ID	Aircraft	Touchdown Distance (ft)	ROT Fuselage (s)	Exit Distance (ft)	Threshold Crossing Speed (kts)	Exit Speed (kts)
2	LGA	N8851K	C310	513.6	46.8	3743.7	95.1	14.6
3	LGA	CNS229	PC12	515.9	47.1	3739.6	88.1	16.5
4	LGA	N232BG	BE9L	516.8	41.0	2730.2	91.3	15.9
5	LGA	N614LD	PC12	517.4	50.1	3795.3	84.6	22.6
6	LGA	N729JR	SR22	519.6	49.5	3723.3	81.4	16.2
7	LGA	CNS12	PC12	521.2	33.2	2729.1	92.6	25.2
8	LGA	N625M	BE58	522.5	48.7	4001.2	87.6	26.2
9	LGA	N614LD	PC12	529.4	48.0	3777.2	91.9	18.6

Task 1

Create a Matlab script to read the data using the built-in function in Matlab. The script should include renaming variables according to the names shown in the header of the Excel file. You are allowed to let Matlab create the script to read the data as well.

Task 2

Create Matlab code to add a histogram of the touchdown distance for all the landing records. Label the histogram appropriately. Your histogram should have 40 bins. Find the most repeated value of touchdown distance for the set.

Task 3

Add Matlab code to the script created in Tasks 1-2 to identify landings performed by the Bombardier CRJ-700 aircraft (aircraft label is CRJ7). Create a new variable to filter the runway threshold crossing speed (units are knots - a nautical mile per hour). Make a histogram of the speed data for the CRJ7. Your histogram should have 20 bins. Label axes accordingly.

Task 4

Add to the Matlab script more code to create a scatter plot with the Aircraft Threshold Crossing Speed (x-axis) and the Exit Distance (y-axis) for all aircraft in the data. Label the scatter plot appropriately. Is there are pattern in the data? Comment.

Task 5

Add to the Matlab script more code to estimate the percent of landings for aircraft of type CRJ7 with runway threshold crossing speeds above 118 knots.

Problem 3

A file containing Amtrak stations is included with this assignment (Amtrak_stations_xlslx). A sample of the data included is shown in Table 2.

Table 2. United States Amtrak Stations.

	A	B	C	D	E	F
1	Longitude_deg	Latitude_deg	Station_Code	County	State	Station_Type
2	-82.440842	38.415405	HUN	Huntington	WV	RAIL
3	-97.930061	38.055859	HUT	Hutchinson	KS	RAIL
4	-85.469925	43.395729	HWC	Howard City	MI	BUS
5	-116.23317	33.714752	IDO	Indio	CA	BUS
6	-94.429298	39.086975	IDP	Independence	MO	RAIL
7	-86.160309	39.762154	IND	Indianapolis	IN	RAIL
8	-117.759193	33.674767	IRV	Irvine	CA	RAIL
9	-90.190598	32.300644	JAN	Jackson	MS	RAIL

Task 1

Create a Matlab script to read the data. Use the built-in import function in Matlab to accomplish the task. The script should include renaming variables according to the names shown in the header of the Excel file (see Table 2).

Task 2

Add to the script created in Task 1 to identify BUS stations. Use the STRCMP command in Matlab to do the matching as shown in class. The original file provided by Amtrak has bus, ferry and other stations. Create a new variable with the BUS stations and display the names of the top 10 bus stations found in the command window. Make a screen capture of the tops stations found and include in your solution.

Task 3

Add code to the script above to find all the rail stations in the US. Retrieve the latitude and longitude coordinates of each rail station and plot (with blue dots) on the US map supplied with the assignment.

Task 4

Add code to the script created in Task 3 to identify the rail stations in the state of Virginia. Display the top 10 stations in Virginia in the Command Window.

Task 5

Create a pie chart using the built-in plot in Matlab (see Figure below) showing the percent of station types in the Amtrak network. Find the percent of stations listed as 'Other' and 'Rail'.