MFM 5054 - Computational Models in Financial Engineering 2023

Final Examination Part 1

1.

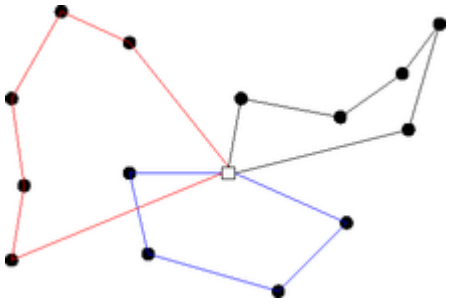
1.1. Load the data given in the car.csv file
1.2. Plot the data.
1.3. Separate last 12-month data for testing. Remaining data should be used to fit the model
1.4. Fit the data using fb prophet model. Check the columns names match with model
1.5. Predict the test data and compare it with the actual data
1.6. Plot the predicted values and actual values in a graph

2.

2.1. Load the data from dry bean classification dataset. Your objective is to predict bean type.
2.2. Convert the data to a suitable format to be used for an ANN
2.3. Separate training and testing data to suitable ratio
2.4. Using tensor flow train an ANN. You can decide the number of layers and neurons
2.5. Train the ANN
2.6. Measure the performance of ANN against test data

3.

The vehicle routing problem (VRP) asks "What is the optimal set of routes for a fleet of vehicles to traverse in order to deliver to a given set of customers?" Consider the following example. A single depot is at the center (marked by white square). Black dots are customers. A vehicle leaves the depot and start delivering goods. But routinely it needs to come back to the depot to pick the next set of goods due to various limitations (e.g. Fuel, Carrying capacity, Shelf life …etc.) following is one possible solution for above problem.



Following table provides distance to major cities in Sri Lanka. A manufacturing firm in Colombo distribute its products to all the said major cities. The distances to each city is given in the table below (you can download an excel sheet of above data from the LMS) .

City	AHUNGALLA	AIRPORT	ANURADHAPURA	BENTOTA	COLOMBO	DAMBULLA	GALLE	HIKKADUWA	HABARANA	KANDY	KALUTARA	NEGOMBO	NUWARA ELIYA	POLONNARUWA	RATNAPURA	SIGIRIYA	TRINCOMALEE	YALA
AHUNGALLA	0	115	286	14	78	229	37	21	250	194	35	118	254	293	112	243	334	213
AIRPORT	115	0	179	101	40	136	152	136	160	112	80	10	186	192	138	152	240	328
ANURADHAPURA	286	179	0	272	208	66	320	307	58	138	248	168	214	101	238	80	106	499
BENTOTA	14	101	272	0	64	214	51	35	235	179	21	104	240	278	98	229	320	227
COLOMBO	78	40	208	64	0	150	115	99	171	115	43	40	189	214	101	165	256	291
DAMBULLA	229	136	66	214	150	0	262	250	29	72	190	136	149	67	173	16	109	363
GALLE	37	152	37	51	115	262	0	16	283	230	72	155	288	330	149	280	371	176
HIKKADUWA	21	136	307	35	99	250	16	0	270	214	56	136	304	314	165	264	355	192
HABARANA	250	160	58	235	171	29	283	270	0	101	214	152	178	42	181	24	90	421
KANDY	194	112	138	179	115	72	230	214	101	0	158	104	77	139	141	90	181	291
KALUTARA	35	80	248	21	43	190	72	56	214	158	0	83	190	258	77	208	299	248
NEGOMBO	118	10	168	104	40	136	155	136	152	104	83	0	181	210	141	152	246	331
NUWARA ELIYA	254	186	214	240	189	149	288	304	178	77	190	181	0	216	147	166	258	192
POLONNARUWA	292	192	101	278	214	67	330	314	42	139	258	210	216	0	240	67	128	376
RATNAPURA	112	138	238	98	101	173	149	165	181	141	77	141	147	240	0	181	282	182
SIGIRIYA	243	152	80	229	165	16	280	264	24	90	208	152	166	67	181	0	109	445
TRINCOMALEE	334	240	106	320	256	109	371	355	90	181	299	246	258	128	282	109	0	477
YALA	213	328	499	227	291	363	176	192	421	291	248	331	192	376	182	445	477	0

3.1. Create a distance matrix based on above table
3.2. The maximum round trip a supply vehicle can travel is 800 km at a time. It needs to return to Colombo before it exceeds the limit.
3.3. Write a GA algorithm to find the collection of routes, with least total distances, to visit each major city at least once. You may visit a city more than once if needed.

4.

4.1. Write a Python program to check if a given positive integer is a power of three
4.2. Write a Python program where you take any positive integer n, if n is even, divide it by 2 to get n / 2. If n is odd, multiply it by 3 and add 1 to obtain 3n + 1. Repeat the process until you reach 1
4.3. Write a Python program to convert the temperature in centigrade to Fahrenheit
4.4. Write a Python program to multiply two matrices