Operations Research
Metaheuristic Assignment
Due Date: Dec. 14, 2018, 5pm

Please zip your files including eg. MS Word, Excel (or csv, txt), **Python code** file or other files, with the file name: **OR_HW_ID_NAME.zip**, and upload your homework to MOODLE by due.

The last digit of your student ID is (1) ODD for Traveling Salesman Problem; (2) EVEN for Single-Machine Scheduling Problem.

(學號末位數為奇數做旅行推銷員、偶數做單機排程問題)

Programming Questions (100%)

Please use *Python* (**MUST use it, other language is not allowed**) to answer the following questions. Provide your code and justify your answer. Show all your work in detail including specific algorithm and parameter design. You should hand in *one ZIP fold (ODD for Traveling Salesman Problem by Simulated Annealing and EVEN for scheduling problem by Tabu)*. The result should include ***approximate optimal solution (i.e., traveling sequence, job sequence), fitness function value, running time.*** For the parameter settings (eg. temperature, cooling rate, tabu size, etc.), please give a simple ***trial-and-error*** adjustment of parameters.

Traveling Salesman Problem (學號末位數為奇數)

Please answer following TSP problem. The objective function is to minimize the total distance.

Data Source: **GR17** is a set of 17 cities, from TSPLIB.

0	633	257	91	412	150	80	134	259	505	353	324	70	211	268	246	121
633	0	390	661	227	488	572	530	555	289	282	638	567	466	420	745	518
257	390	0	228	169	112	196	154	372	262	110	437	191	74	53	472	142
91	661	228	0	383	120	77	105	175	476	324	240	27	182	239	237	84
412	227	169	383	0	267	351	309	338	196	61	421	346	243	199	528	297
150	488	112	120	267	0	63	34	264	360	208	329	83	105	123	364	35
80	572	196	77	351	63	0	29	232	444	292	297	47	150	207	332	29
134	530	154	105	309	34	29	0	249	402	250	314	68	108	165	349	36
259	555	372	175	338	264	232	249	0	495	352	95	189	326	383	202	236
505	289	262	476	196	360	444	402	495	0	154	578	439	336	240	685	390
353	282	110	324	61	208	292	250	352	154	0	435	287	184	140	542	238
324	638	437	240	421	329	297	314	95	578	435	0	254	391	448	157	301
70	567	191	27	346	83	47	68	189	439	287	254	0	145	202	289	55
211	466	74	182	243	105	150	108	326	336	184	391	145	0	57	426	96
268	420	53	239	199	123	207	165	383	240	140	448	202	57	0	483	153
246	745	472	237	528	364	332	349	202	685	542	157	289	426	483	0	336
121	518	142	84	297	35	29	36	236	390	238	301	55	96	153	336	0

Please use Simulated Annealing (SA) algorithm to solve the problem and provide the total distance. Show your parameter design (i.e. temperature, cooling rate) and the result.

Single-Machine Scheduling Problem (學號末位數為偶數)

Please answer following single-machine total weighted tardiness problem. The objective function is to minimize the total weighted tardiness.

Jobs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Processing Time	10	10	13	4	9	4	8	15	7	1	9	3	15	9	11	6	5	14	18	3
Due Date	50	38	49	12	20	105	73	45	6	64	15	6	92	43	78	21	15	50	150	99
Weights	10	5	1	5	10	1	5	10	5	1	5	10	10	5	1	10	5	5	1	5

Please use Tabu Search (TS) algorithm to solve the problem and provide the total weighted tardiness. Show your parameter design (i.e. tabu list size) and the result.

Note

1. Show all your work in detail. **Innovative** idea is encouraged.
2. If your answer refers to any external source, please "must" give an academic citation. Any

 "**plagiarism**" is not allowed.