Documentation of optimization tool

This optimization tool will be personally used by the scheduling team to optimize schedules for the Marketing and Data Science and Operations departments in upcoming semesters. To use this tool, the end user will already have a file similar to the sample input already constructed and execute the optimization tool through their computer terminal to be able to have an optimized output schedule of potential assignments.

The purpose of this optimization tool is to not just produce a final class schedule from a black box, but to simply give Shannon and Hal, the end users of this tool, another option as they make course assignments during Phase II. Flexibility is very important, and from the final output file, the scheduling team may choose which parts to incorporate into the final schedule.

A detailed step-by-step process of the optimization tool usage is described below:

1. Update input files to be in a similar format as the sample input files
2. Install Python onto computer
3. Confirm that input files are in the same computer location as the optimization tool file, ie. all files are in the same folder
4. Open Terminal and ensure the current directory is the same folder where all of the input files and optimization tool is currently located
5. Run the optimization tool by running the command line:
    - *ipython optimize.py RoomOccupency_2015-3.csv course_info.csv student_perf.csv room_capacities.csv output_1.csv*
6. Output file will be created similar to the sample output file

To discuss more detail about the input, for this optimization tool, there should be 4 inputs in total:

- ***Course Information (course_info.csv)***

  The data including each course's term, program, type(core/elective), section, title, unit, department, if it will be held in first half or second half of the semester, if it's a semi-week course, teaching hours per week and registered students number. The format should be organized as below.

term	program	course	core	section	title	unit	department	first_half	second_half	semi_week	hours_per_week	pred_reg_count
20191	MBA	GSBA-528	1	15725	Marketing Management	3	MKT	0	1	0	4	75
20191	MBA	BUAD-307	1	14836	Marketing Fundamentals	4	MKT	0	0	0	2	39
20191	MBA	MKT-566	0	16542	Marketing Analytics	3	MKT	0	0	1	3	54
20191	MSBA	DSO-583	0	16292	Operations Consulting	3	DSO	0	0	1	3	42
20191	MSBA	DSO-545	1	16278	Statistical Computing and Data Visualization	3	DSO	0	0	0	3	54
20191	MSBA	DSO-570	1	16298	The Analytics Edge: Data, Models, and Effective Decisions	3	DSO	0	0	1	3	52
20191	EMBA	XYZ-123	1	1235	Core 1	3	ACCT	0	0	0	3	60
20191	EMBA	ABC-123	1	9876	Core 2	3	ACCT	0	0	0	4	60
20191	EMBA	EFG-456	0	8754	Elective 1	3	MKT	0	0	0	2	35

- ***Room Capacities (room_capacities.csv)***

  This input data should contain all the available classrooms' name and its maximum capacity, just as the example format below.

Room	Size
ACC 306B	16
ACC201	48
ACC205	36
ACC236	39
ACC303	46
ACC306B	16
ACC310	54
ACC312	20
BRI202	42
BRI202A	34

- ***Room Occupancy (RoomOccupency_2015-3.csv)***

  For the room occupancy input data, it contains the occupancy status of each room that Marshall can use. In the excel file, 1 represents the room has been occupied at that time slot, and blank represents the room is still available and the optimization tool can schedule unassigned course at that room, below is the example of format.

Session ID	Time	JKP102	JKP104	JKP110	JKP112	JKP202	JKP204	JKP210	JKP212
1	M8.0	1		1	1	1		1	1
2	M8.5	1		1	1	1	1	1	1
3	M9.0	1		1	1	1	1	1	1
4	M9.5	1	1	1	1	1	1	1	1
5	M10.0	1	1		1	1	1	1	1
6	M10.5	1	1		1	1	1	1	1
7	M11.0		1	1	1	1		1	1
8	M11.5		1	1	1	1		1	1

- ***Student Preference (student_pref.csv)***

  This input is organized from the survey for students' time preference of each course. We calculated the average preference as our input, example shown as below.

course_code	time	avg_pref
GSBA-528	Morning	1.2
GSBA-528	Afternoon	2.4
GSBA-528	Evening	1.8

With these organized inputs and the optimization tool, we can easily get our outputs of the optimized results, in below format. As the example shown, the course will be assigned to a specific classroom and time slot, in the excel, 1 represents the room has already been taken during Phase 1, while 0 represents the classroom is still available after Phase 2, provides more flexibility for future use.

As the example shown, the course will be assigned to a specific classroom and time slot, in the excel, 1 represents the room has already been taken during Phase 1, while 0 represents the classroom is still available after Phase 2, provides more flexibility for future use.

Session ID	Time	JKP102	JKP104	JKP110	JKP112	JKP202	JKP204	JKP210	JKP212
1	M8.0	1	0	1	1	1	0	1	1
2	M8.5	1	0	1	1	1	1	1	1
3	M9.0	1	0	1	1	1	1	1	1
4	M9.5	1	1	1	1	1	1	1	1
5	M10.0	1	1	0	1	1	1	1	1
6	M10.5	1	1	0	1	1	1	1	1
7	M11.0	DSO-570	1	1	1	1	0	1	1
8	M11.5	DSO-570	1	1	1	1	0	1	1
9	M12.0	DSO-570	1	1	0	1	0	0	0