Assignment 2 – Resource Constraining and Resource Allocation

All assignments in this course require modeling; recommended platforms are C++, JAVA, Python and/or MATLAB.

1. Develop a model that conducts **resource constraining**.
Your model takes as input:
   -   an **excel file** that contains a table with the format presented in the default example below
   -   a **resource constraint** value (a number).

Your model will return:
   -   Resource histogram for the _original_ schedule (before constraining) with resource constraint drawn as a line on the histogram. The vertical axis shows the resource number and horizontal axis, the time (day).
   -   Revised (post constraining) histogram (only final stage is required).
   -   Original and revised schedule: either as barcharts (graphical), or as a Table or Tabulated text with 10 columns as below. **ES_0** shows the original date and **ES_r** shows the revised (post constraining) dates.

Activity	Duration	ES_0	EF_0	LS_0	LF_0	ES_r	EF_r	LS_r	LF_r

Default Example: Use the example below as the default example to print output example. However, your model should be able to take _any_ other table in excel file; i.e. with any <u>number of activities</u>, <u>durations</u>, <u>relationships</u> and <u>dependencies</u>, as well as any <u>resource constraint</u> value.

Activity	Duration	Depends on	Relationship/lag	Resource Requirement/day
A	6	---		8
B	3	A	SS (A, B)=3	16
C	4	A	SS (A, C)=4	10
D	8	B	FS (B, D)=2	12
E	9	A	SS (A, E)=5	12
F	6	C		9
G	1	D	SS (D, G)=5	7
H	6	G, E	FF (G, H)=4	4

Resources constraint for this example: **38**/day

2. Develop a model that conducts **resource allocation (Crashing).**

Your model takes as input:
- an **excel file** that contains a table with the format presented in the default example below
- an **overhead cost** ($value).

Your model will return:
- The result of *every* step of crashing as below format:

Step1:

- Activity (ies) crashed: _____   (list all the activities that are crashed at this step)
- Critical Path(s): _____   (write all the existing critical paths after crashing at this step)
- Project Duration:_____   (at this step)
- Cost/Saving:_____   (at this step)
- Cumulative cost/saving: _____ (to the project, at this step)

Step2: …

- Original and *final* (only final) schedule: either as barcharts (graphical), or as a Table or Tabulated text with 10 columns as below. ES_0 shows the original date and ES_r shows the revised (post crashed) dates.

Activity	Duration	ES_0	EF_0	LS_0	LF_0	ES_r	EF_r	LS_r	LF_r

Default Example: Use the example below as the default example to print output example. However, your model should be able to take *any* other table in excel file.

Note: The difference between the Crash and Normal costs in this table reflects the penalty for the difference in time between Crash and Normal durations as depicted in the table.

Activity	Duration	Depends on	Crash Duration	Normal Cost	Crash Cost
A	6	---	4	400	460
B	11	---	9	750	780
C	16	---	13	800	890
D	7	A, B	5	450	490
E	3	B	3	200	200
F	10	C	8	600	640
G	9	D, E	8	500	525
H	6	C, E	4	250	300
I	5	F	3	350	370
J	6	F	3	450	510
K	10	G, I	7	550	595
L	7	H, J	4	300	330

Overhead cost of project: **$30** per day.

Submission Requirements:

For each question:
1. Hard copy (return to **drop boxe located on the 3rd floor of Engineering block F** marked as ENCI 697)
- A printout of the return answers for the default example
- A brief report (max two pages) that explains your logic. This can contain figures (e.g. flowchart). The font size in any figure cannot be smaller than 9pt. If you have used any existing packages, please elaborate on their functionality.
   If for any reason your program is not completed, please explain the current capability of your program (things it can and cannot do). E.g. it can only solve the default example, but not any other examples.

2. Soft copy (submit to **Assignment 2 Dropbox folder** on D2L with your name as File name)
- A well-commented **source code**. If it is easier to run your code as a pre-packed solution, then submit your whole solution; however, make sure to clean it first to not include any ".exe" files. Your program should be commented well enough for the instructor to understand it.
- A PDF copy of the report