

ENAE 483/788D LECTURE #02 (SYSTEMS ENGINEERING) – FALL, 2022

The following tasks describe a project which you need to analyze and manage. Task durations are given in weeks; assume the project starts at Week 0 (i.e., Alpha will be done at the end of Week 1).

Task	Precedent Tasks	Duration (weeks)
Alpha	-	1
Bravo	Alpha	4
Charlie	Alpha	3
Delta	Alpha	5
Echo	Alpha	3
Foxtrot	Alpha	1
Golf	Alpha	3
Hotel	Bravo, Charlie, Delta	3
India	Charlie, Delta, Echo	1
Juliett	Delta, Echo, Foxtrot	2
Kilo	Echo, Foxtrot, Golf	3
Lima	Foxtrot, Golf	4
Mike	Bravo, Hotel	4
November	Hotel, India	2
Oscar	India, Juliett	1
Papa	Juliett, Kilo	5
Quebec	Kilo, Lima	2
Romeo	Golf, Lima	3
Sierra	Mike, November	4
Tango	Mike, November, Oscar	2
Uniform	November, Oscar, Papa	5
Victor	Oscar, Papa, Quebec	3
Whisky	Papa, Quebec, Romeo	2
Xray	Sierra, Tango, Uniform	4
Yankee	Uniform, Victor, Whisky	1
Zulu	Uniform, Xray, Yankee	2

(1) Draw a Gantt chart for this program. You can use project management software if you have it (several are available for free online) or draw it manually.

*See attached figure.*

(2) Draw a PERT chart for this program. Again, use whatever software or manual techniques you choose.

*See attached figure.*

(3) What is the minimum time (in weeks) it will take to complete the project?

*24 weeks*

(4) What is the critical path?

*Alpha-Delta-Juliet-Papa-Uniform-Xray-Zulu, shown by red box borders on the PERT chart.*

- (5) How much slack time does task Oscar have?

*4 weeks*

- (6) Consider the five planned project concepts for ENAE 484: homesteading Mars, lunar polar tourism, lunar cargo transport, an Earth-Moon L1 station, and networked lunar science rovers. List your order of preference for these missions from most favorite to least favorite.

- (7) Respond to the following ten questions. The allowable answers are (strongly agree), (agree), (neither agree nor disagree), (disagree), and (strongly disagree)

*Your selections will vary, but I'm going to make selections at random to illustrate how the calculations should work*

- (a) I prefer Homesteading Mars to Lunar Tourism

*neither agree nor disagree = 1*

- (b) I prefer Homesteading Mars to Lunar Cargo Transport

*strongly disagree = 1/9*

- (c) I prefer Homesteading Mars to Earth-Moon L1 Station

*agree = 3*

- (d) I prefer the Homesteading Mars to Networked Lunar Science Rovers

*agree = 3*

- (e) I prefer Lunar Tourism to Lunar Cargo Transport

*strongly disagree = 1/9*

- (f) I prefer Lunar Tourism to Earth-Moon L1 Station

*agree = 3*

- (g) I prefer Lunar Tourism to Networked Lunar Science Rovers

*agree = 3*

- (h) I prefer Lunar Cargo Transport to Earth-Moon L1 Station

*strongly agree = 9*

- (i) I prefer Lunar Cargo Transport to Networked Lunar Science Rovers

*strongly agree = 9*

- (j) I prefer Earth-Moon L1 Station to Networked Lunar Science Rovers

*disagree = 1/3*

- (8) Use the solution method for the Analytical Hierarchy Process outlined in the lecture to do an AHP analysis of your own opinion on next term's project themes. and list the resultant weightings of your opinions. Does it correspond to your subjective rankings from question (6) above? Did the result surprise you in any way?

Use the ratings from the selections, populate the other diagonal of the matrix with the reciprocal numbers, and sum the columns

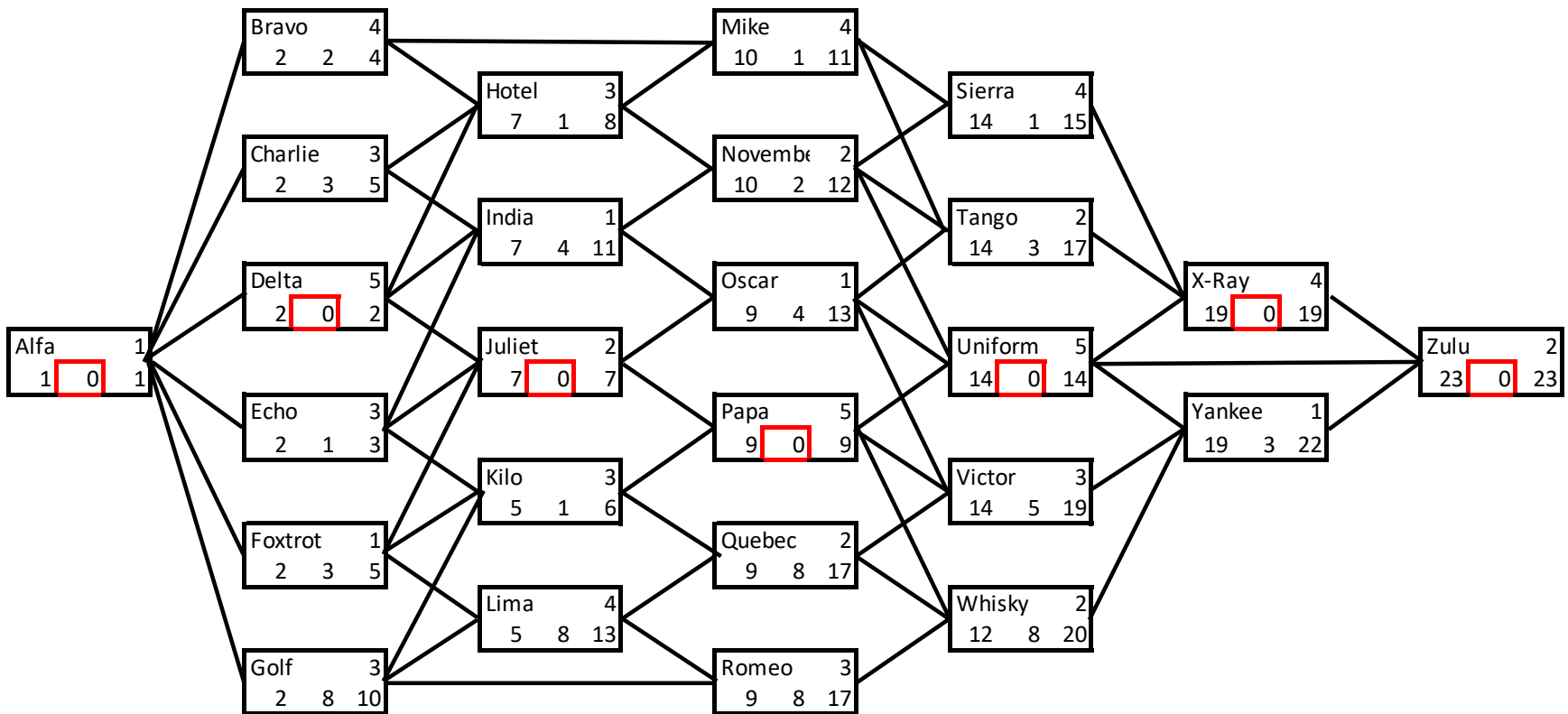
	Mars Home	Tourism	Lunar Cargo	L1 Station	Sci Rovers
Mars Home		1	0.111	3	3
Lunar Tourism	1		0.111	3	9
Lunar Cargo	9	9		0.111	
L1 Station	0.333	0.333	0.111		9
Sci Rovers	0.333	0.333	0.111	3	
column sums	10.67	10.67	0.444	18	15.33

Normalize the columns by dividing each cell by the column sums (including the diagonal cells), and average across the rows to get the results

	Mars Home	Tourism	Lunar Cargo	L1 Station	Sci Rovers	
Mars Home	0	0.094	0.25	0.167	0.196	0.141
Lunar Tourism	0.094	0	0.25	0.167	0.196	0.141
Lunar Cargo	0.844	0.844	0	0.5	0.587	0.555
L1 Station	0.031	0.031	0.25	0	0.022	0.067
Sci Rovers	0.031	0.031	0.25	0.167	0	0.096

So the totals in the right-hand column are the strengths of the preferences - here, a strong preference for the lunar cargo transporter, next choice evenly split between Homesteading Mars and the Lunar Polar Tourism projects, and little interest in the Earth-Moon L1 Station or Networked Science Rovers.

There's no "right answer" here, just an opportunity to get some experience doing an AHP analysis. How did it compare with your preferences expressed in the first-day survey for 483?



Task name		Duration
Earliest Start	Slack Time	Latest Start

