Assignment 08

1. Problem 1

A 30-year-old buys, for $7,200 (in year 0), a Registered Retirement Savings Plan (RRSP) bond that will pay 4% ($288 per year) into the plan for the next 40 years, and will then be redeemed for $7,200 plus accumulated interest. The interest payments issued each year go into the RRSP (starting at year 1) and also earn 4% per year. Because it is an RRSP, the purchaser receives an immediate tax rebate of $7,200 times the marginal tax rate (at a marginal tax rate of 36%). The purchaser will pay no taxes on the annual interest earned until the end of the 40 years, when the original amount and all earned interest are withdrawn and taxed (at a future marginal rate of 26%). At age 70, when the RRSP is redeemed, taxes must be paid on both the original amount and the accumulated interest. What is the rate of return on this investment, rounded to the nearest tenth of a percent?

Total earned:

$\$7,200(F/P, 4\%, 40) = \$34,567$

Interest:

$\$34,567 - \$7,200 = \$27,367$

Tax on Interest:

$\$27,367 \times 26\% = \$7,116$

Net Interest Income:

$\$27,367 - \$7116 = \$20,251$

Rate of Return:

$$\frac{\$20,251}{\$7,200} \times \frac{100}{40} = 7.03\%$$

2. Problem 2

A university wants to calculate its weighted average cost of capital (WACC). It plans to withdraw $68 million from savings, which had been earning 6% interest. It is paying 4.5% annual interest on $30 million in bonds (through annual payments). It receives $94 million in general funds from taxpayers, and believes that that source of funds should be assigned an interest rate of 12%. What is the university's weighted average cost of capital? Round your answer to one decimal place (x.x%).

$$\frac{\$68,000,000 \times 0.06 + \$30,000,000 \times 0.045 + \$94,000,000 \times 0.12}{\$68,000,000 + 30,000,000 + \$94,000,000} \times 100\% = 8.7\%$$

3. Problem 3

A machine has a first (capital) cost of \$12,000. The repair costs are covered by the warranty in year 1, then they increase by \$550 per year. Assume an interest rate of 12%.

(a) Calculate the EUAC for the first 10 years of the machine's use, rounding to the nearest dollar.

(b) Identify the minimum EUAC for this machine, and the year it occurs.

(c) Based on this value, what how many years should the machine be used before it is sold?

$EUAC_{cap} = EUAC\ of\ capital\ recovery\ cost$

$Main = Maintenance$

$EUAC_{main} = EUAC\ of\ maintenance$

$EUAC_{tot} = Total\ EUAC$

Year	Capital	(A/P,i,n)	$EUAC_{cap}$	Main.	(A/G,i,n)	$EUAC_{main}$	$EUAC_{tot}$
0	\$12,000						
1	\$10,560	1.120	\$13,440	\$0	0.000	\$0	\$13,440
2	\$9,293	0.592	\$7,100	\$550	0.472	\$259	\$7,360
3	\$8,178	0.416	\$4,996	\$1,100	0.925	\$509	\$5,505
4	\$7,196	0.329	\$3,951	\$1,650	1.359	\$747	\$4,698
5	\$6,333	0.277	\$3,329	\$2,200	1.775	\$976	\$4,305
6	\$5,573	0.243	\$2,919	\$2,750	2.172	\$1,195	\$4,113
7	\$4,904	0.219	\$2,629	\$3,300	2.551	\$1,403	\$4,033
8	\$4,316	0.201	\$2,416	\$3,850	2.913	\$1,602	\$4,018
9	\$3,798	0.188	\$2,252	\$4,400	3.257	\$1,792	\$4,044
10	\$3,342	0.177	\$2,124	\$4,950	3.585	\$1,972	\$4,095

(a) EUAC for the first ten years are on the rightmost column of above table

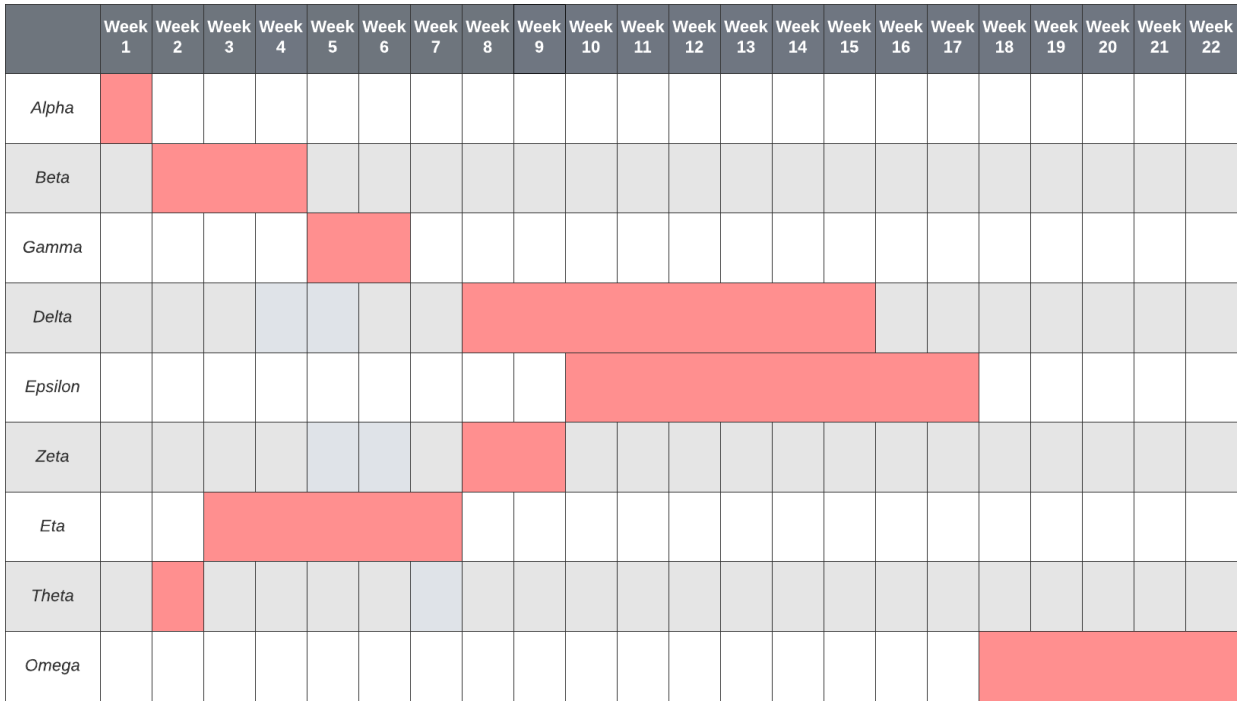
(b) Minimum EUAC is \$4,018 at year 8.

(c) We cannot say how many years it should be used since we do not have either marginal cost data or the minimum EUAC of the competitor. Without marginal cost data, we will be using Analysis Technique 3, which will need the minimum EUAC of the competitor.

4. Problem 4

Study the following table and construct a Gantt chart. If no activity can commence until all its prerequisites are completed, what is the shortest time in which the overall project could be completed?

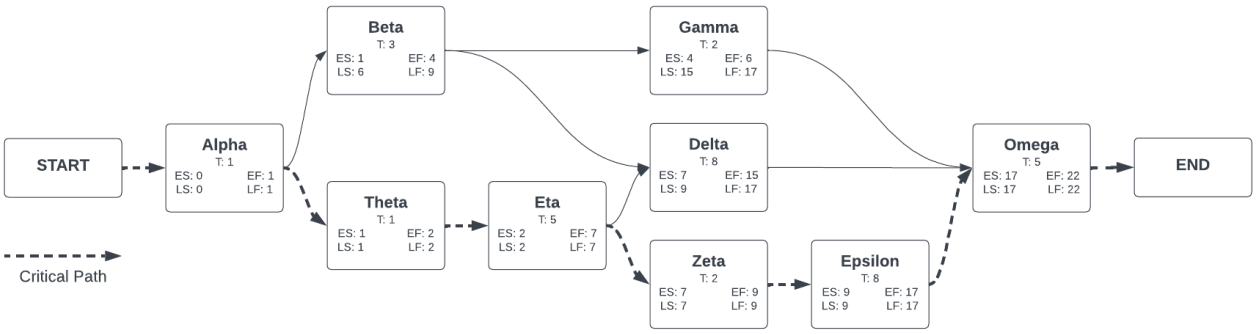
Activity	Duration (weeks)	Prerequisite
Alpha	1	None
Beta	3	Alpha
Gamma	2	Beta
Delta	8	Beta, Eta
Epsilon	8	Zeta
Zeta	2	Eta
Eta	5	Theta
Theta	1	Alpha
Omega	5	Gamma, Epsilon, Delta



The shortest amount of time to complete overall project is 22 weeks.

5. Problem 5

Referring to the previous problem, apply CPM to the data provided and identify the critical path. Which activity has the greatest slack?



Gamma has the greatest slack, with 11 weeks.

For a better view of the CPM image, see ELEC 481 A9 P5.png file submitted together with the assignment.