**Engineering Management Principles and Economics**

**ENGR301**

**Tutorial 4**

These questions are sourced from chapter 7 of the course text.

**Question 1**

What is the time estimate of the following activity in which the optimistic estimate is 4 days, pessimistic is 12 days, and most likely is 5 days? Show your work.

Using the Beta distribution for probabilistic estimation, the formula is given as:

$$TE = (a + 4m + b)/6$$

Where:

TE = Estimated time for activity

$a$ = most optimistic time to complete the activity

$m$ = most likely time to complete the activity, the mode of the distribution

$b$ = most pessimistic time to complete the activity

The solution to this problem is:

$$TE = (4 + 4(5) + 12)/6, \text{ or}$$
$$= 6$$

**Question 2**

Calculate the direct cost of labor for the project team using the following data. What are the costs for the individual project team members? What is the overall direct cost of labor?

| **Name** | **Hours Needed** | **Overhead Charge** | **Personal Time Rate** | **Hourly Rate** | **Total Direct Labor Cost*** |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Sandy | 60 | 1.35 | 1.12 | $18/hr. | **$1,633** |
| Chuck | 80 | 1.75 | 1.12 | $31/hr. | **$4,861** |
| Bob | 80 | 1.35 | - 0 - | $9/hr. | **$972** |
| Penny | 40 | 1.75 | 1.12 | $30/hr. | **$2,352** |

**Total Direct Labor Cost = $9,818***

*these are the calculated values (the answers)

**Question 3**

It took MegaTech, Inc. 100,000 labor-hours to produce the first of several oil drilling rigs for Antarctic exploration. Your company, Natural Resources, Inc. has agreed to purchase the fifth oil drilling rig from their manufacturing yard. Assume that MegaTech experiences a learning rate of 80%. At a labor rate of $35 per hour, what should you, as the purchasing agent expect to pay for the fifth unit?

Using the formula, to produce the fifth unit takes:

$T_N = T_1 X^b$

Where $T_N$ = Time needed to produce the $N^{th}$ unit

$T_1$ = Time needed to produce the first unit

X = Number of units

b = log(learning rate)/log(2)

$T_5$ = (100,000) 5^(log(0.8)/log(2)) = 100,000 * 5^(-0.3219)

= 100,000 * 0.596 = 59,600 hours

To find the cost, multiply the hours by the hourly rate:

= (59,600) ($35 per hour)

= $2,086,000

**Question 4**

Question 3 identified how long it should take to complete the fifth oil drilling platform that Natural Resources plans to purchase. How long should all five oil-drilling rigs take to complete?

The total time necessary to complete the five rigs is calculated as:

$T_{1\text{-}5}$ = (100,000) [1 + 2^(-0.3219) + 3^(-0.3219) + 4^(-0.3219) + 5^(-0.3219)]

= (100,000) [3.738] = 373,800 hours to complete all five oil-drilling rigs

**Question 5**

Suppose that you are the assigning costs to a major project to be undertaken by your firm, DynoSoft Applications, this year. One particular coding process involves many labor hours, but highly redundant work. You anticipate a total of 200,000 labor hours to complete the first iteration of the coding and a learning curve rate of 70%. You are attempting to estimate the cost of the twentieth iteration of this coding sequence. Based on the above information and at a $60 per hour labor rate, what would you expect to budget as the cost of the twentieth iteration? The fortieth iteration?

$T_{20}$ = $T_1X^b$

= (200,000) * 20^(log(0.7)/log(2))

= (200,000) * 20^(-0.5146)

= 42,800 hours

$T_{40}$ = T1C

= (200,000) * 40^(log(0.7)/log(2))

= (200,000) * 40^(-0.5146)

= 30,000 hours

The costs for the $20^{th}$ and $40^{th}$ iterations are found as:

$20^{th}$ iteration: (42,800 hours) ($60 per hour) = $2,568,000

$40^{th}$ iteration: (30,000 hours) ($60 per hour) = $1,800,000