Final Exam

Steve Mazza

December 18, 2011

In all cases please consult the accompanying spreadsheet for clarification of the calculations.

1. Using ordinary least squares regression I calculate the following key values:

	Coefficients
Intercept	−20.86713
Sorties	0.51197
Experience	−0.51064

   I then calculate the predicted monthly cost of Unscheduled Maintenance Actions as follows:

$$\begin{aligned}\text{Monthly Cost} &= 5 \times \$1,000 \times (-20.86713 + 30 \times 0.51197 + 3 \times -0.51064) \\ &= \$5,000 \times (-20.86713 + 15.3591 - 1.5319) \\ &= \$5,000 \times 7.0399 \\ &= \$35,199.65\end{aligned}$$

   Please see the accompanying spreadsheet for justification.

2. Using the data provided, a first missile production unit could be estimated at $5.2M using the Wright learning curve approach as follows:

$$\begin{aligned}2,500,000 &= a10^{\left(\frac{\log_{10} .8}{\log_{10} 2}\right)} \\ 2,500,000 &= 0.47651a \\ a &\approx 5.24648 \times 10^6 \\ a &\approx 5,246,480\end{aligned}$$

3. The COCOMO II model was used with the following inputs:

   - Required Development Schedule: LOW
   - SW Required Reliability: HIGH
   - Language and Toolset Experience: HIGH
   - Platform Volatility: LOW
   - Use of Software Tools: VERY HIGH

- % Design Modified: 20
- % Code Modified: 33
- % Integration Required: 67
- % Assessment and Assimilation: 2
- % Software Understanding: $(30 + 30 + 20)/3 \approx 27$
- Unfamiliarity: 1

For the basis of calculation I used \$10K per person-month as the cost for the software engineering effort.

Month	Inception	Elaboration	Construction	Transition	Hardware	Monthly Total
1	$183,883.25				$145,735.56	$329,618.81
2	$183,883.25				$145,735.56	$329,618.81
3	$183,883.25				$145,735.56	$329,618.81
4	$183,883.25				$145,735.56	$329,618.81
5		$245,177.67			$145,735.56	$390,913.22
6		$245,177.67			$145,735.56	$390,913.22
7		$245,177.67			$145,735.56	$390,913.22
8		$245,177.67			$145,735.56	$390,913.22
9		$245,177.67			$145,735.56	$390,913.22
10		$245,177.67			$145,735.56	$390,913.22
11		$245,177.67			$145,735.56	$390,913.22
12		$245,177.67			$145,735.56	$390,913.22
13		$245,177.67			$145,735.56	$390,913.22
14		$245,177.67			$145,735.56	$390,913.22
15		$245,177.67			$145,735.56	$390,913.22
16		$245,177.67			$145,735.56	$390,913.22
17			$465,838		$145,735.56	$611,573.06
18			$465,838		$145,735.56	$611,573.06
19			$465,838		$145,735.56	$611,573.06
20			$465,838		$145,735.56	$611,573.06
21			$465,838		$145,735.56	$611,573.06
22			$465,838		$145,735.56	$611,573.06
23			$465,838		$145,735.56	$611,573.06
24			$465,838		$145,735.56	$611,573.06
25			$465,838		$145,735.56	$611,573.06
26			$465,838		$145,735.56	$611,573.06
27			$465,838		$145,735.56	$611,573.06
28			$465,838		$145,735.56	$611,573.06
29			$465,838		$145,735.56	$611,573.06
30			$465,838		$145,735.56	$611,573.06
31			$465,838		$145,735.56	$611,573.06
32			$465,838		$145,735.56	$611,573.06
33			$465,838		$145,735.56	$611,573.06
34			$465,838		$145,735.56	$611,573.06
35			$465,838		$145,735.56	$611,573.06
36			$465,838		$145,735.56	$611,573.06
37				$367,766.50		$367,766.50
38				$367,766.50		$367,766.50
39				$367,766.50		$367,766.50
40				$367,766.50		$367,766.50
					Grand Total:	**$19,711,961.00**

4. (a) The *uniform* distribution applies in this case as the description is taken almost exactly from the definition.

   (b) While this appears to be somewhat *normal*, there is a strong indication that the Nominal values

will prevail. On the other hand, this does not appear to be so clear as to be represented by a *triangle* distribution. It is possible that the most appropriate model here is the *lognormal* distribution.

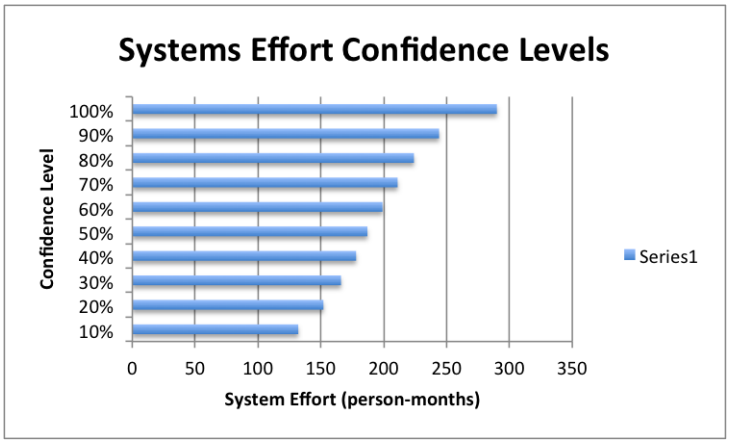
(c) This probabilities in this case are most appropriately represented by the *normal* distribution.

(d) Since there appears to be a most likely value, the *triangle* distribution would apply here.

5. The COSYSMO model was used with the following inputs:

   - System Size
     - 30 easy requirements
     - 60 nominal requirements
     - 40 difficult requirements
     - 6 nominal interfaces
     - 6 difficult interfaces
     - 15 nominal algorithms
     - 5 difficult algorithms
     - 3 nominal operational scenarios
     - 1 difficult operational scenario
   - Requirements Understanding: LOW
   - Process Capability: HIGH
   - Personnel Experience: HIGH
   - Labor Cost: $10,000 per person-month

   The graph below indicates the resulting confidence levels.



The calculations indicate that my Command can assume an approximately 15% probability of achieving the contractor's bid.

A 70% confidence level estimate for actual budgeting and risk reserve would be met within a 211 person-months, or $2,110,000.00.

6. Using the formula supplied,

$$\text{Effort (Person-Months)} = 0.25 \times \text{System Requirements}^{1.06}$$

I calculate the original cost without process improvement to be 181.5 person-months or \$1,814,881.25. Using the modified formula,

$$\text{Effort (Person-Months)} = 0.25 \times \text{System Requirements}^{1.03}$$

I calculate the new cost with the process improvement to be 150.6 person-months or \$1,506,187.76 for a savings of 30.9 person-months or \$308,693.49 annually.

The 5-year Return On Investment (ROI) is calculated to be \$5.17 for each dollar spent as follows:

$$\begin{aligned}
\text{ROI} &= (5 \times \text{Savings} - \text{Costs})/\text{Costs} \\
&= (5 \times \$308,693.49 - \$250,000.00)/\$250,000.00 \\
&= (\$1,543,467.45 - \$250,000.00)/\$250,000.00 \\
&= \$1,293,467.45/\$250,000.00 \\
&= \$5.17
\end{aligned}$$

7. The results are based on the following adjustments to the System Cost Drivers:

	COA 1	**COA 2**
Technology Risk	High	Nominal
System Level of Service Requirements	Low	Nominal
Requirements Understanding	High	Nominal
Number of Recursive Levels in the System Design	Low	Nominal
System Architecture Understanding	High	Nominal

Note that I used a value of High for the Technology Risk. The three criteria you gave us did not agree so I assumed that the Risk would necessarily be equivalent to the worst case.

Please see the accompanying spreadsheet for an explanation of the calculations. A summary of the annual costs follows:

	COA 1	**COA 2**
FY12	\$2,050,459.57	\$2,878,384.40
FY13	\$2,603,993.60	\$1,649,750.54
FY14	\$4,347,253.04	\$2,386,694.82
FY15	\$3,945,656.47	\$1,218,426.92
FY16	\$2,740,866.75	\$1,112,220.75
FY17	\$2,740,866.75	\$1,112,220.75

I was tempted to assume that, "the years FY12 to FY17," is a 60-month period but decided to include FY17 calculations as well just to be safe. Please omit FY17 numbers (which are maintenance only) if this is not what you intended.