Homework 6

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"I pledge my honor that I have abided by the Stevens Honor System." - JM, EO, DB, MM

Summary:

For this assignment, the team is tasked with providing COCOMO® II cost and schedule estimates for the prototype and development of a proposed MedFRS system. Given parameters for both prototyping and development, the team was able to calculate these estimates using the formulations shown in class. The team determined after estimating that the total system cost and schedule fall within the $600k budget and 24-month time restraint given.

The total software portion of a proposed MedFRS system is $600K. MedFRS case summary provides feasibility evidence of the $600K budget, including the development of a prototype of the new integrated patient-monitoring systems and 4G communications on a single first-responder vehicle and one level 1 trauma center.

1. **(5 points).** Perform a COCOMO® II cost and schedule estimate for developing the prototype, using the following parameters: a prototype size estimate of 5 KSLOC and an average developer cost of $8K per person-month. The COCOMO® II parameter ratings are all Nominal (round off the all-Nominal exponent to be 1.10) except for:

    RELY: Low; since the prototype will not be operational

    CPLX: High; some complex cross-device and external interfaces

    ACAP: Very High; prototype needs top talent

    PCAP: Very High; prototype needs top talent

    APEX: High; prototypers are familiar with medical field

    PLEX: Low; prototypers unfamiliar with new devices

    RUSE: Low; prototype code will not be reused

EM_i = RELY * CPLX * ACAP * PCAP * APEX * PLEX * RUSE = 0.92 * 1.17 * 0.71 * 0.76 * 0.88 * 1.09 * 0.95 = <u>0.5292</u>

$$\text{Effort (person-months)} = A \times (\text{Size})^E \times \prod_{i=1}^{\#\text{ of cost drivers}} EM_i$$

A = 2.94 (constant)

Size = 5 KSLOC (given)

E = 1.10 (given)

EM_i = 0.5292 (calculated above)

Effort = 2.94 * (5 KSLOC)$^{1.10}$ * 0.5292 = **<u>9.1376 Person-months</u>**

$$\text{TDEV} = 3.67 \times PM^{[0.28+0.2\times(E-0.91)]} =$$

C = 3.67 (constant)

Effort = 9.1376 PM (calculated above)

D = 0.28 (constant)

B = 0.91 (constant)

E = 1.10 (given)

TDEV = 3.67 * (9.1376 PM)$^{(.28 + .2(1.1 - .91))}$ = **<u>7.4167 Months</u>**

Cost = 9.1376 * $8k = **<u>$73,100.80</u>**

2. **(5 points).** Assume that the prototype has been successful. The prototype has not only provided evidence of feasibility of the approach, but also has determined the likely size of the full development to be 21 KSLOC, and provided evidence for lower ratings for the system's complexity CPLX (now Nominal due to experience with the prototype). However, the full

team will include the prototypers and new, less-capable and less-experienced developers, reducing ACAP and PCAP from Very High to High, although PLEX is improved to Nominal and RUSE is set to High to enable reuse among the Ensayo hospitals. It also reduces the team's average salary to $7K per person-month.

For the full system, perform a COCOMO® II cost and schedule estimate, assuming that the average developer cost is $7K per person-month, and the remaining COCOMO II parameter ratings are all Nominal (round off the all-Nominal exponent to be 1.10), leaving the following non-Nominal ratings

RELY: Very High; since the system needs to be safety-critical

ACAP: High; some Nominal-capability analysts added to team

PCAP: High; some Nominal-capability programmers added to team

APEX: High; some Nominal-experienced developers added to team

RUSE: High.

EM_i = RELY * ACAP * PCAP * APEX * RUSE = 1.26 * .85 * .88 * 1.07 = **0.8874**

$$Effort\ (person\text{-}months) = A \times (Size)^E \times \prod_{i=1}^{\#\ of\ cost\ drivers} EM_i$$

Effort = 2.94 * (21 KSLOC)$^{1.10}$ * 0.8874= **74.286 Person-months**

A = 2.94 (constant)

Size = 21 KSLOC (given)

E = 1.10 (given)

EM_i = 0.8874 (calculated above)

$$\text{TDEV} = 3.67 \times PM^{[0.28+0.2\times(E-0.91)]} =$$

C = 3.67 (constant)

Effort = 74.286 PM (calculated above)

D = 0.28 (constant)

B = 0.91 (constant)

E = 1.10 (given)

TDEV = 3.67 * (74.286 PM)$^{(.28 + .2(1.1 - .91))}$ = **14.44 Months**

Cost = 74.286 * $7k = **$520,002**

Does the total cost and schedule of the prototype and full development fit within the $600K budget and 24-month schedule?

Total Cost = $73,100.80 + $520,002 = $593,102.80 < $600,000

Total Schedule = 7.4167 Months + 14.44 Months = 21.8567 Months < 24 Months

Yes, the cost and schedule of the prototype and full development fits within the $600k budget and 24-month schedule.