1. Business Case Analysis, 30 points (usually graded by Jim)

As indicated in the ICSM book Table 6-4, the MedFRS Initial Operational Capability (IOC) will cost $2 million to develop and $1 million per year to operate and maintain. Besides the benefits in human life and health saved, which are generally agreed not to be given dollar values, the conservative annual savings in hospital and operations costs are estimated to be 10% for each of the 4 areas in the Ensayo region. Each of the 4 areas averages $10 million per year in hospital and operations costs.

Compute the Return on Investment (ROI) for the savings produced for the Ensayo region by the IOC investment for each of the first three years of the IOC operation.

Annual costs: 4 areas * $10M/area = $40M.
(3 points total: 1 point for calculating all 4 areas, 1 point for correct cost ($10M), and 1 point for correct answer – even if not explicit in answer)

Annual savings: 10% of $40M = $4M.
(3 points total: 1 point for 10%, 1 point for total cost, 1 point for correct savings amount – even if not explicit)

(24 points total for either Approach.)

**Approach 1 (from slide 27 of the Business Case lecture (EC-5))**:
ROI for Year 1 = ($4M - $3M) / $3M = 33.3%.
(8 points: 2 points for correct equation form, 2 points for correct savings, 2 points for correct cost, 2 points for correct final answer)

ROI for Year 2 = ($8M - $4M) / $4M = 100%.
(8 points: 2 points for correct equation form, 2 points for correct savings, 2 points for correct cost, 2 points for correct final answer)

ROI for Year 3 = ($12M - $5M) / $5M = 140%.
(8 points: 2 points for correct equation form, 2 points for correct savings, 2 points for correct cost, 2 points for correct final answer)

**Approach 2 (from section 2.6.1 of the COCOMO II book (EP-2))**:
Net savings is the same every year. Only investment is cost to develop. Therefore:
Annual ROI = Net savings per year / Initial cost.
Cumulative ROI = 3 * Annual ROI.

Initial cost = $2M.
Per year cost = $1M.

Net savings per year = $4M - $1M = $3M.
(4 points: 2 points for correct equation form, 2 points for correct final answer)

Annual ROI = $3M / $2M = 1.5.
(10 points: 8 points for correct equation form, 2 points for correct final answer)

Cumulative ROI = 3 * 1.5 = 4.5.
(10 points: 8 points for correct equation form, 2 points for correct final answer)

2. COCOMO II Estimate, 40 points (usually graded by Anandi)

The MedFRS long-range plan is to devote the first year of its IOC operation to analyze stakeholder feedback and operational experience, and to use the results to prioritize the features and quality attributes to be developed in the next 2 years and $2 million budget for the MedFRS Full Operational Capability (FOC).

2.1 FOC COCOMO II Estimate, 30 points. The FOC estimated size is 60KSLOC. Its scale factor and cost driver ratings are all Nominal except for High ratings for the scale factors Architecture and Risk Resolution (RESL) and Team Cohesion (TEAM), and the following cost driver ratings: Very High for RELY, and High for DATA, CPLX, ACAP, PCAP, and PLEX. The cost per person-month is $8K. Estimate the FOC project effort, cost and development schedule.

Scale Factor = 0.91 + 0.01 * (3.72+3.04+2.83+2.19+4.68) = 1.075
(7 points total – 1 for correct equation form, 1 for constants (0.91, 0.01), 1 point for correct RESL, 1 point for correct TEAM, 1 point total for correct nominal ratings for other scale drivers, and 2 points for correct final exponent value)

EAF = 1.26 * 1.14 * 1.17 * 0.85 * 0.88 * 0.91 = 1.144
(5 points total – 0.5 for RELY, 0.5 for DATA, 0.5 for CPLX, 0.5 for ACAP, 0.5 for PCAP, 0.5 for PLEX, 2 for correct EAF value)

Effort = 2.94 * 60^{1.075} * 1.144 = 274.3379 PM
(6 points total – 2 for equation form, 1 for correct constant (2.94), 1 for correct KSLOC, 2 for correct PM)
Schedule Exponent = 0.28 + 0.2 * (1.075 – 0.91) = 0.313
(5 points total – 2 for equation form, 1 for constants, 2 for correct schedule exponent)

Schedule = 3.67 * (274.3379)^0.313 = 21.274 months
(4 points total – 1 for equation, 1 for constants, 2 for correct schedule)

Cost = $8K * 274.3379 = $2194.703K
(3 points total – 1 for cost per PM, 2 for final cost)

2.2 Fitting Budget and Schedule, 10 points. Do the estimated cost and schedule fit within the planned and budgeted $2 million and 24 months? Where they do not? Identify at least 3 workable strategies for modifying the estimate inputs to get the cost and schedule to fit. (Note: Recalculations not necessary). An example of a workable strategy is: Convince the stakeholders that not as much reliability is needed, so that RELY can be reduced from Very High to High. (Of course, this strategy MAY NOT be used as an answer.)

Schedule fits within 24 months. Effort is above $2M (1 point for correct comparison). Workable strategies for modifying the estimate inputs to get the cost and schedule to fit include (3 points per good strategy – 1 point for change/potential solution, 2 points for correct and good strategy/explanation to reach the solution):

Examples of workable strategies:
- Dropping low-priority features
- Providing developer completion bonuses to improve PCON rating
- Finding more experience performers to improve APEX, LTEX ratings
- Collocating the development team to improve the SITE rating.
3. True-False Questions. 30 points; 3 points each. (usually graded by Jim)
Put either “T” or “F” on the line preceding the statement. Grading will be based on this alone, not any additional statements or explanations provided.

1. __T___ A system development will succeed if and only if it makes winners of its success-critical stakeholders. per ICSM book p. 10.

2. __F___ Diagrams are more important than principles in guiding a project’s decisions. per ICSM p. 16.

3. __T___ It is important to consider the risk of going forward in making a project’s decisions. per ICSM p. 17, 98.

4. __F___ If the risk of going forward is high, the project should always seek more evidence. per ICSM p. 106.

5. __T___ It is risky to ask a project to maximize, minimize, or optimize a system’s aspect. per ICSM p. 40-41.

6. __T___ A good practice is to concurrently engineer a project’s requirements and design. per ICSM p. 94.

7. __F___ A good practice is to concurrently engineer a project’s design and development. per ICSM 0.85.

8. __F___ A COCOMO estimate should include the size of COTS products included in the delivered system. per EP-2 p. 4 (COCOMO II book p. 15).

9. __T___ COCOMO can be used to quantify the software costs involved in a business case analysis. per EP-2 p. 50 (COCOMO II p. 60).

10. __F___ A business case should be restricted to quantifiable costs and benefits. per Business Case lecture charts.