Tutorial 2

1. For a software project, you were given the following information:

Number of	Inputs	Outputs	Inquiries	ILF	EIF	Algorithms
Value	17	35	20	6	5	25

General Sys. Charac. (GSCs)	Influence Rating
Data Communication	5
Distrib. Data Processing	3
Performance	4
Heavily Used Config.	5
Transaction Rate	3
Online Data Entry	2
End-user Efficiency	3
Online Updates	1
Complex Processing	5
Reusability	2
Installation Ease	1
Operational Ease	4
Multiple Sites	3
Facilitate Change	4

a. Use the Feature Points method to estimate the size of this project in LOC. Assume that each feature point (FP) will require an average of 100 LOC. Show every step of the calculations.

   size(UFP) = sum(function type * feature point weight) = (17*4) + (35*5) + (20*4) + (6*7) + (5*7) + (25*3) = 475 FPs
   Total degree of influence: TDI = sum(ratings) = 5 + 3 + 4 + 5 + 3 + 2 + 3 + 1 + 5 + 2 + 1 + 4 + 3 + 4 = 45
   Value adjustment factor: VAF = 0.65 + (0.01*TDI) = 0.65 + (0.01*45) = 1.1
   Size in adjusted function points: size(AFP) = VAF * size(UFP) = 1.1 * 475 = 522.5 FP
   Based on the provided assumption, estimated project size = 522.5 * 100 LOC = **52250 LOC**.

b. To which level of difficulty does this project fall into, assuming the Cocomo basic model? Estimate the required effort of the project (in Staff-month).

   Project is 52250 LOC = 52.25 KLOC
   Based on the size, it is greater than 50KLOC so the project difficulty would be semi-detached. Because there are no cost drivers for the project, we would use the basic Cocomo model:
   Effort = a * size^b = 3 * 52.25^1.12 = 251.98 ≈ **252 staff months**

2. For a software project, you were given the following information:

Complexity →	Simple	Average	Complex
# of Actors	2	5	5
# of Use Cases	4	10	15

Technical Complexity Factors		
Factor	**Description**	**Rating**
T1	Distributed system	1
T2	Response or throughput performance objectives	3
T3	End-user efficiency	5
T4	Complex internal processing	3
T5	Reusable code	3
T6	Easy to install	5
T7	Easy to use	5
T8	Portable	2
T9	Easy to change	3
T10	Concurrent	2
T11	Includes security features	3
T12	Provides access for third parties	2
T13	Special user training facilities are required	1

Environment Adjustment Factors		
Factor	**Description**	**Rating**
F1	Familiar with Rational Unified Process	3
F2	Application experience	3
F3	Object-oriented experience	5
F4	Lead analyst capability	3
F5	Motivation	4
F6	Stable requirements	3
F7	Part-time staff	3
F8	Difficult programming language	2

a. Use the Use Case Points method to estimate the size of this project in KLOC (thousands of LOC). Assume that the average number of LOC per use case is 120 LOC/UC. Show every step of your calculations with the used equations.

UAW = sum(actors * weight) = (2 * 1) + (5 * 2) + (5 * 3) = 27
UUCW = sum(use cases * weight) = (4 * 5) + (10 * 10) + (15 * 15) = 345
UUCP = UAW + UUCW = 27 + 345 = 372
TSUM = sum(rating * weight) = (1 * 2) + (3 * 2) + (5 * 1) + (3 * 1) + (3 * 1) + (5 *0.5) + (5 * 0.5) + (2 * 2) + (3 * 1) + (2 * 1) + (3 * 1) + (2 * 1) + (1 * 1) = 39
TCF = 0.6 + (0.01 * TSUM) = 0.6 + (0.01 * 39) = 0.99
ESUM = sum(rating * weight) = (3 * 1.5) + (3 * 0.5) + (5 * 1) + (3 * 0.5) + (4 * 1) + (3 * 2) + (3 * -1) + (2 * -1) = 17.5
EF = 1.4 - (0.03 * ESUM) = 1.4 - (0.03 * 17.5) = 0.875
UCP = UUCP * TCF * EF = 372 * 0.99 * 0.875 = 322.245 ucp
Based on the provided assumption, estimated project size = 322.245 * 120 LOC = 38669.4 LOC = **38.6694 KLOC**

b. Based on (a), to which level of difficulty does this project fall into, using the Cocomo effort estimation model? Estimate the required effort for the project (in Staff- month) using the basic model. Again, show the used equation along with your calculations.

Project is 38.669 KLOC
Based on the size, it is less than 50KLOC so the project difficulty would be organic. Because there are no cost drivers for the project, we would use the basic Cocomo model:
Effort = a * size^b = 2.4 * 38.669^1.05 = 111.416 ≈ **112 staff months**

3. Your company is developing a network intrusion detection system (NIDS) software for a certain high-level client. The NIDS is supposed to use a hybrid detection mechanism that depends on a signature database for known attacks/threats (faster and guaranteed detections) and anomaly detection algorithm (ADA) for unknown attacks/threats (40% chance of early detection). The project was already in its development phase and have passed several milestones when some new serious network security threats were revealed. These threats can be used in many ways (most are still unexplored) to launch new attacks at client's network. Your underdevelopment software needs to detect these new attacks.

   As a project manager, you want to assess the risk and take suitable actions. Hence, you had a few quick Delphi sessions with different experts, and reached the following conclusions:

   1. There are TWO possible situations:
      a. SIT#1: Your software is able to detect the new attacks early. The software operates as normal, and no additional support is needed➔Cost = $0.
      b. SIT#2: The software fails to detect the new attacks (or detecting them late). In this case, your company will provide additional support to clients to recover from the security incident and must update the software system (costs up to $1M). There will be some expected legal actions (e.g., lawsuits, compensations, etc.) with expected cost up to $40M.
   2. You have THREE options to go forward (for each of these options, the two situations mentioned above apply):
      a. OPT#1: Do Nothing. In this option, your project continues as normal without any modifications. Your company will assume that the current ADA (as designed) is good enough to detect the new attacks as is.
      b. OPT#2: Change the Anomaly Detection Algorithm, so the chances of detecting unknown attacks (such as the newly discovered ones) increases to 65% early detection. This requires going back and changing at least one product milestone, updating the following activities and work products. In addition it will require hiring at least two new experts in anomaly detection algorithms. This option will

need the following costs:

Cost Description	Expected Cost
Hiring overhead for the new staff	$0.25M
Code inspection (for previous work)	$0.25M
Creating/improving the ADA	$0.35M
Applying changes to previous work (including previous milestones)	$0.75M
Salaries for the new staff	$1.50M
Admintration overhead	$0.75M
Schedule delay penalty	$3.00M

c. OPT#3: Add attack signatures to the NIDS' database only. Basically, your team will create signatures for the few known attacks that use the newly-discovered security threats, and assume the current ADA is enough to detect the still-unknown attacks that might use the discovered security threats. This means the following changes:

Cost Description	Expected Cost
Creating the signature and updating the database	$0.55M
Overtime/extra working hours salaries for the current teams	$1.50M
Admintration overhead	$0.25M
Schedule delay penalty	$1.25M

3. Based on the experts' opinions, the chances for having each of the considered situations for each option are as follows:
   Based on all of this information, you will make your decision:
   a. Create the decision tree, calculate the risk exposure (RE) for each situation at each option, and total RE for each option.

      Note that SIT #2 has a default cost of $41M associated with it.

Option	Situation	Probability (P)	Loss (L)	Risk Exposure (P*L)	Total RE per OPT
OPT 1	SIT 1	0.4	$0		**$24.6 M**
	SIT 2	0.6	$41M	$24.6M	
OPT 2	SIT 1	0.65	$6.85M	$4.4525 M	**$21.2 M**
	SIT 2	0.35	$47.85 M	$16.7475M	
OPT 3	SIT 1	0.5	3.55	$1.775 M	**$24.05 M**
	SIT 2	0.5	44.55	$22.275 M	

   b. Based on the basic calculation in (a), which option do you recommend? And why?

      Based on the calculations in part a), **OPT #2 is ideal** because its RE is the least out of all the options.

c. Since you are weighing mitigation options to a risk (meaning, OPT#1 represents the situation before risk mitigation, and each of OPT#2 and OPT#3 represent different “after” mitigation options), calculate the risk reduction leverage (RRL) for each mitigation option.

   RE before = $24.6M
   For OPT #2:
   RRL = (RE before - RE after) / cost of risk = (24.6 - 21.2) / 6.85 = **0.496**
   For OPT #3:
   RRL = (RE before - RE after) / cost of risk = (24.6 - 24.05) / 3.55 = **0.155**

d. Now, based on (c) , which option do you recommend? And why?

   Based on part c), **OPT #2 is still better** as its RRL is higher. However both RRLs are below 1 meaning neither are technically worth it.