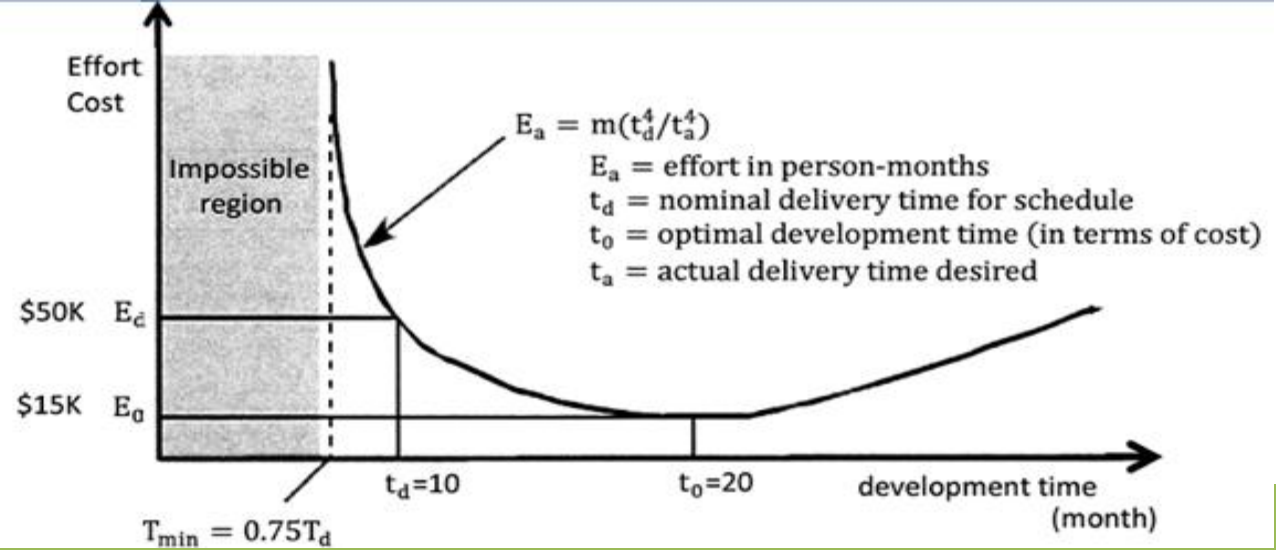# Tutorial 4: 6Qs

1. Given an effort-time graph and figures, read and understand the Graph.

2. The LOC estimates for each function are noted in parentheses. estimate the effort and cost required to build the software using the LOC-base estimation technique described.

3. If there are a total of 20,000 lines of white-box reused code in a system and 30% of this is automatically generated, compute the effort required to integrate this generated code.

4. Using the formula, productivity table and estimated application points, estimate the person-months needed if the project has a **highly experienced** team and the expected level of reuse code is about half.

5. Discuss the problems associated with estimation using use-cases.

6. A software project manager is faced with the options to make/buy a piece of software. Draw a decision tree to support the decision process and make your recommendation when some criteria are taken into consideration.

T4_Q1 ans.

Effort Cost

Impossible region

$E_a = m(t_d^4/t_a^4)$
E_a = effort in person-months
t_d = nominal delivery time for schedule
t_o = optimal development time (in terms of cost)
t_a = actual delivery time desired

$50K E_d

$15K E_o

$t_d=10$ $t_o=20$ development time (month)

$T_{min} = 0.75 T_d$

i) The possible 2 reasons:
   • speed up=> OT => more errors;   fall sick => extra costs
   • bring in premier staff => pay premier fees for those persons
ii) When td=10, E_d=$50K
iii) No. Every project has some overhead. t_d=10, T_{min}=0.75*10 = 7.5 months. This indicates that any development time less than 7.5 month reaches impossible region. The project has a high risk of failure.
iv) 20 months
v) The cost will go up. If allows the team to develop the project with more than necessary time, t> t0, it is waste of time, and the cost goes up too, as do unnecessary testing, documentation to fill up the time, payment to the members. So the cost will go up.

Assume that you are the project manager for a company that builds software for household robots. For the purposes, we do a simple functional decomposition, and estimation in LOC for each function. A total of 6450 LOCs are estimated. Assuming that your organization produces 500 LOC/pm with a burdened labor rate of $8000 per person-month, estimate the effort and cost required to build the software using the LOC-based estimation technique described.

The LOC estimates for each function are given in parentheses:
- user interaction (LOC = 2400)
- sensor monitoring (LOC=1100)
- message display (LOC=850)
- system configuration (LOC=1200)
- system control [activation/deactivation] (LOC=900)

A total of 6450 LOC are estimated.

Using the data noted in the problem:

    6450 LOC / 500 LOC/pm = 12.9 pm

    Cost: 12.9 pm * $8,000/pm => $103,000 ~ 103,500

T4_Q3_ans:

The formular: PM = (NAP * (1 - % reuse)) / PROD
where NAP is the total number of application points in the delivered system.

Given: the number of estimated application points is 100;
     50% reuse code;
      highly experienced team

The Productivity Table:

Developer's experience	Very low	Low	Nominal	High	Very high
PROD (NOP/month)	4	7	13	25	50

Therefore: PM = (100 * (1 – 50 / 100)) / 50
    = 1 person-month

T4_Q4_ans:

The formula: PM = (ASLOC * AT) / ATPROD

Where *AT* is the percentage of adapted code that is automatically generated and *ATPROD* is the productivity of engineers in integrating such code.
*ASLOC* denotes the Adapted Source Lines of Code

Given: ATPROD to be about 2,400 source statements per month.
Total of 20,000 lines of white-box reused code in a system and 30% of this is automatically generated

Therefore: PM = (20,000 * (30/100)) / 2,400
= 2.5 person-months

T4_Q5: Problems Associated with Estimation using use-cases:

- Use-cases are described using many different formats and styles – there is no standard form.

- Use-cases represent an external view (the user's view) of the software and are often written at different levels of abstraction.

- Use-cases do not address the complexity of the functions and features that are described.

- Use-cases do not describe complex behavior (e.g., interactions) that involves many functions and features.

T4_Q6 ans
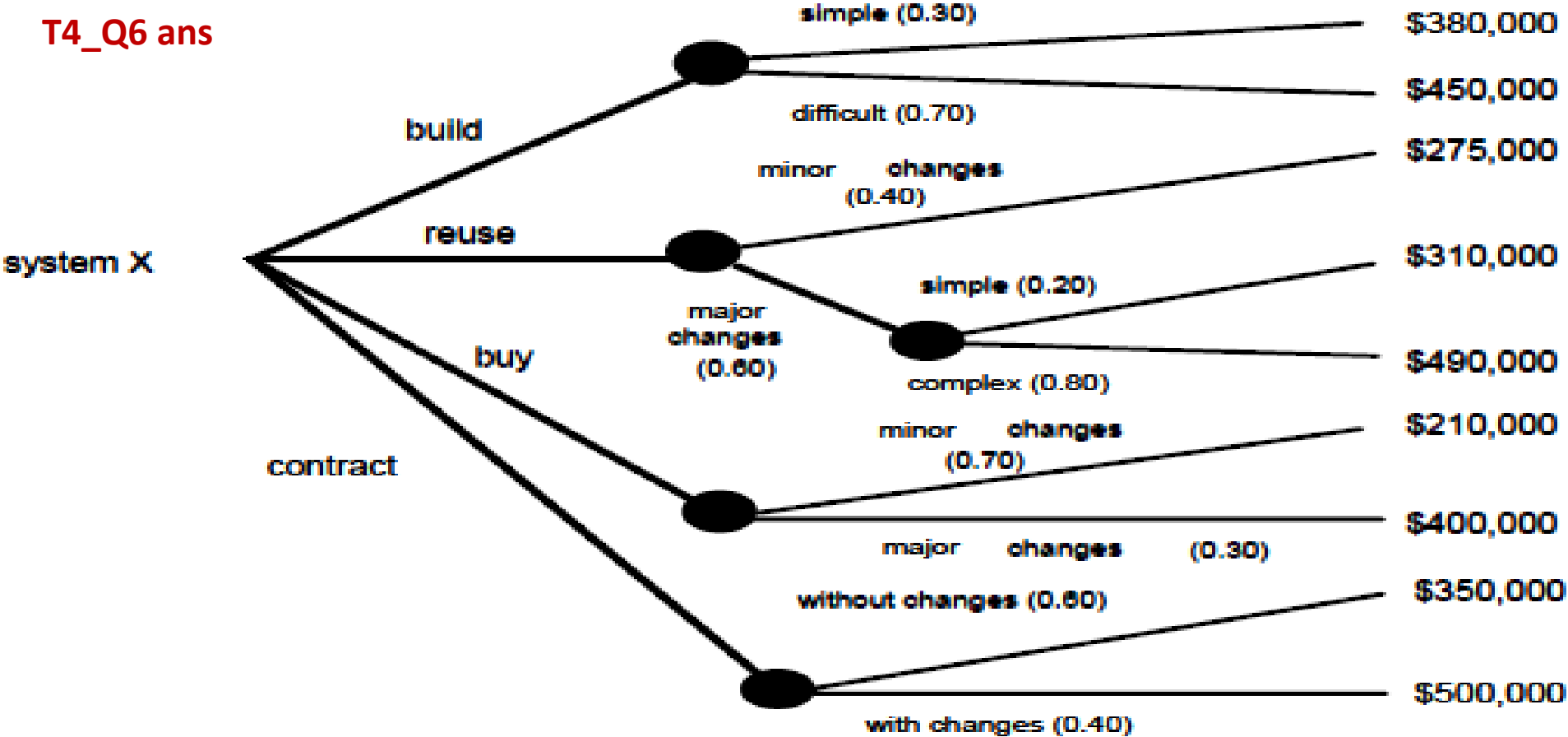
Expected cost-build = 0.30 * (380K) + 0.70 * (450K) = $429K

Expected cost_reuse = 0.40 *(275K)+ 0.60 *0.20*(310K) + 0.60 *0.80 * (490K) = $382K

Expected cost_buy = 0.70 * (210K) + 0.30 * (400K) = $267K

Expected cost_outsource = 0.60 * (350K) + 0.40 * (500K) = $410K

Recommendation: (i) If training team is the criteria: Build

(ii) Cost is the only criteria: Buy