Problem 3:

1. Estimating project effort using the **Use Case Points (UCP) approach**

1. Determine and Calculate UUCP.

2. Determine and Calculate TCF.

3. Determine and Calculate ECF.

4. Determine PF.

5. Calculate UCP.

6. Calculate the Estimated Number of Person-Hours.

The equation for effort estimation is given by:

Effort Estimate = UCP \* PF.

The UCP equation is given by:

UCP = UUCP \* TCF \* ECF

The UUCP equation is given by:

UUCP = UAW + UUCW.

Where:

• UAW (Unadjusted Actor Weight) represents the complexity of the user interface (actors) of the system.

• UUCW (Unadjusted Use Case Weight) represents the complexity of the functional requirements (use cases) of the system.

Effort (in person-months)UCP = UUCP x TCF x ECF

Where:

• UUCP is the total Unadjusted Use Case Points.

• TCF (Technical Complexity Factor) is a factor that considers technical aspects of the project.

• ECF (Environmental Complexity Factor) is a factor that considers the project's environmental and organizational aspects.

Let's calculate UCP, TCF, and ECF with sample values.

**Step 1: Identify Use Cases and Assign Complexity Weights**

Assume you have identified 10 use cases and have assigned the following complexity weights:

• 3 Use cases Simple: 1 points

• 4 Use cases Average: 2 points

• 3 Use cases Complex: 3 points

**Step 2: Calculate UUCW (Unadjusted Use Case Weight)**

UUCW = (3 \* 1) + (4 \* 2) + (3 \* 3) = 3+8+9 = 20 points

**Step 3: Calculate UAW (Unadjusted Actor Weight)**

Assume there are 5 actors (e.g., software developers, project managers, quality analysts). Assign complexity weights to actors based on their interaction complexity with the system.

•2 Actors Simple: 1 points

•2 Actors Average: 2 points

•1 Actor Complex: 3 points

UAW = (2 \* 1) + (2 \* 2) + (1 \* 3) = 2+4+3 = 9 points

**Step 4: Calculate UUCP (Total Unadjusted Use Case Points)**

UUCP = UUCW + UAW = 20+ 9 = 29 points

**Step 5: Determine Technical Complexity Factor (TCF) and Environmental Complexity Factor (ECF)**

Assign TCF and ECF values based on your project's technical and environmental factors. For example:

• TCF = 0.75 (The TCF ranges from a minimum of 0.60 (if the Perceived Impact Factor is 0 in all cases) to a maximum of 1.30 (if the Perceived Impact Factor is 5 in all cases))

• ECF = 0.50 (The ECF ranges from a minimum of 0.425 (if Part-Time Workers and Difficult Programming Language are 0, and all other values are 5) to a maximum of 1.7 (if Part-Time Workers and Difficult Programming Language are 5, and all other values are 0)).

**Step 6: Calculate Effort**

**Effort = UUCP x TCF x ECF = 29 x 0.75 x 0.50 ≈10.875 person-months**

So, the estimated effort for this project is approximately 10.875 person-months.

**b)** To estimate the effort for a software project using **Basic COCOMO 81**,

we need to consider several factors, including the size of the project.

and the complexity of the development environment. The formula is as follows:

**Effort (E) = a \* (KLOC) ^ b person-months**

Where:

• E is the effort required for the project in person-months.

• KLOC is the size of the project in thousands of lines of code.

• a and b are constants that depend on the development environment and project complexity.

For Basic COCOMO 81, the values of 'a' and 'b' can be determined based on the type of project and development mode. Here, we consider example values for our project in the organic mode:

• a (for organic mode) = 2.4

• b (for organic mode) = 1.05

Now, let's assume you have identified that your project is expected to have a size of 5000 lines of code. You can use these values to estimate the effort:

**Effort (E) = 2.4 \* (5) ^ 1.05**

**Effort (E) ≈ 13.008 person-months**

So, for a project size of 5,000 lines of code in the organic mode, the estimated effort is approximately 13.008 person-months.

**c)** Comparison between the estimates derived from the Use Case Points (UCP) approach and COCOMO 81 (Basic COCOMO), let's consider the specific example values used for both methods:

**UCP Estimate:**

• UCP estimated an effort of approximately 10.875 person-months for the project.

• This estimate is based on the complexity of use cases, actors, and environmental factors and is focused on the functional requirements of the project.

**COCOMO 81 Estimate:**

• COCOMO 81 estimated an effort of approximately 13.008 person-months for the project.

• This estimate is based on the size of the project, specifically 5,000 lines of code (5 KLOC), and is technology driven.

**Actual Effort:**

• The actual effort required for the project might be different from both estimates.

• The actual effort can be influenced by factors such as team experience, project-specific challenges, development tools, and methodology.

**Comparing the Estimates:**

• The UCP estimate is noticeably lower than the COCOMO 81 estimate. This difference may be due to the UCP approach not directly considering lines of code as a size metric.

• UCP's lower estimate could suggest that the project's functional requirements and complexity are not as significant as compared to the size of the project.

• COCOMO 81's estimate is higher due to its emphasis on the project's size in lines of code.