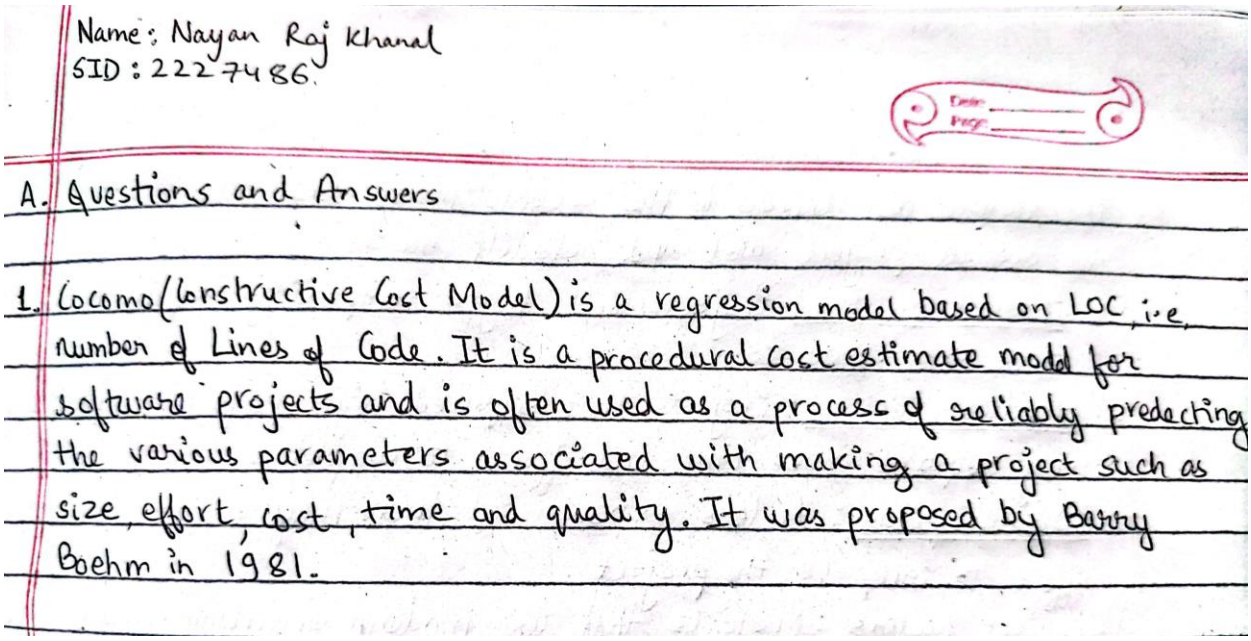
A. Questions and Answer:

1. What is the COCOMO model, and how is it used in software development?

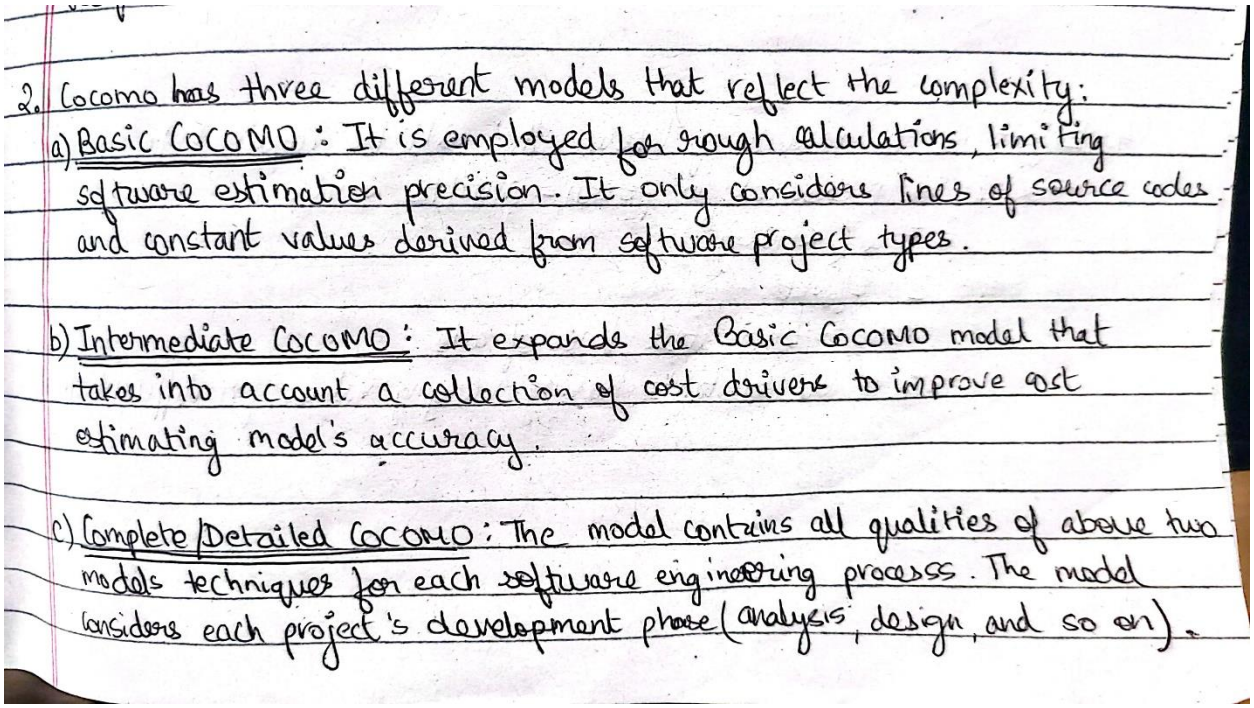


Name: Nayan Raj Khanal
SID: 22274486

A. Questions and Answers

1. Cocomo (Constructive Cost Model) is a regression model based on LOC, i.e. number of Lines of Code. It is a procedural cost estimate model for software projects and is often used as a process of reliably predicting the various parameters associated with making a project such as size, effort, cost, time and quality. It was proposed by Barry Boehm in 1981.

2. What are the three different levels of the COCOMO model, and how do they differ in terms of complexity?

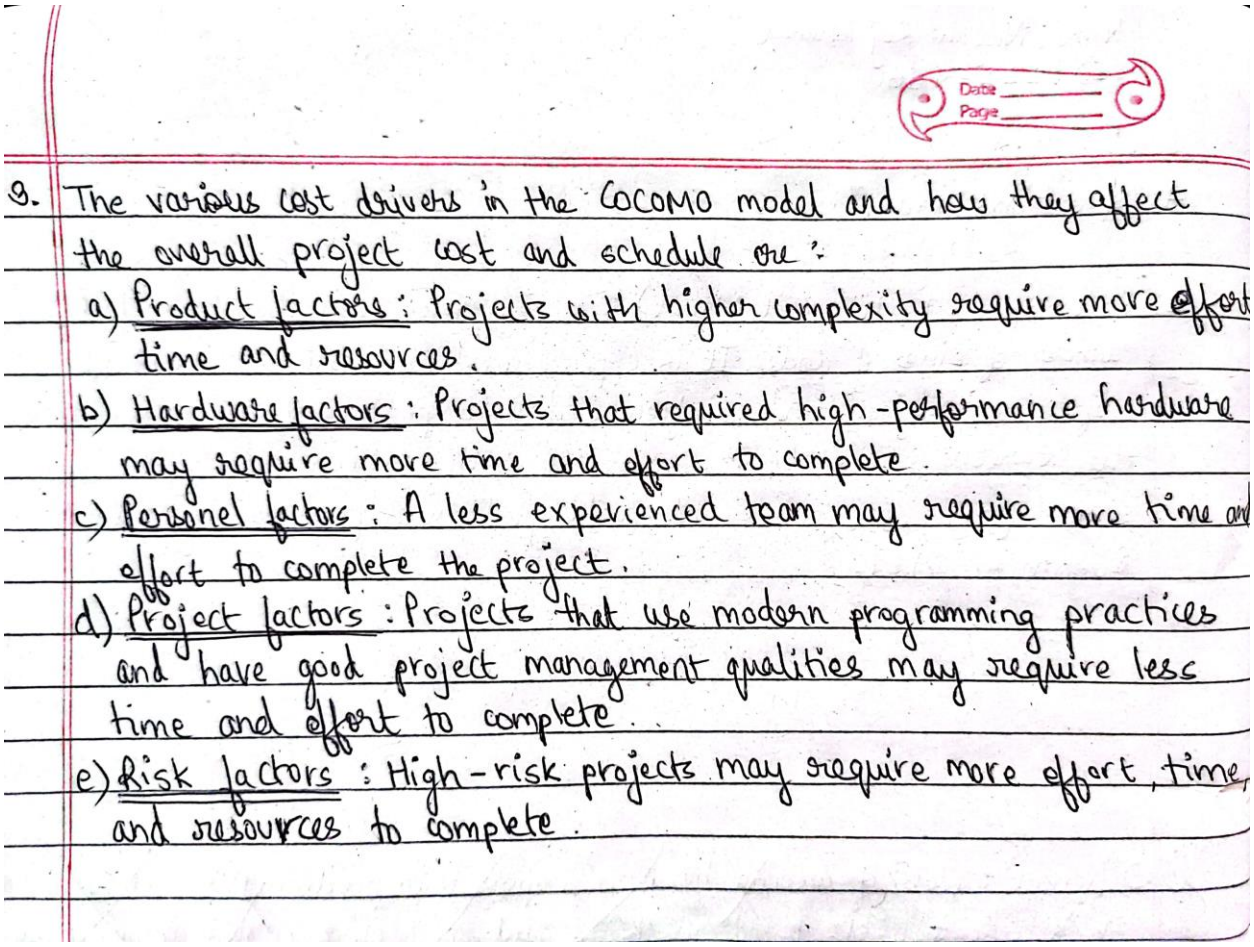


2. Cocomo has three different models that reflect the complexity:
a) Basic COCOMO: It is employed for rough calculations, limiting software estimation precision. It only considers lines of source codes and constant values derived from software project types.

b) Intermediate COCOMO: It expands the Basic COCOMO model that takes into account a collection of cost drivers to improve cost estimating model's accuracy.

c) Complete/Detailed COCOMO: The model contains all qualities of above two models techniques for each software engineering processs. The model considers each project's development phase (analysis, design, and so on).

3. How do the various cost drivers in the COCOMO model affect the overall project cost and schedule?



9. The various cost drivers in the COCOMO model and how they affect the overall project cost and schedule are :

a) Product factors : Projects with higher complexity require more effort time and resources.

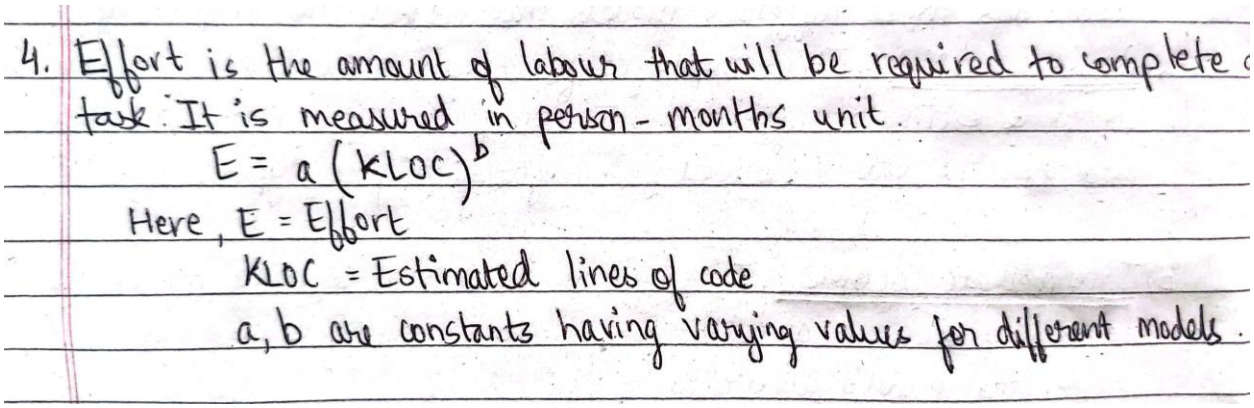
b) Hardware factors : Projects that required high-performance hardware may require more time and effort to complete.

c) Personel factors : A less experienced team may require more time and effort to complete the project.

d) Project factors : Projects that use modern programming practices and have good project management qualities may require less time and effort to complete.

e) Risk factors : High-risk projects may require more effort, time, and resources to complete.

4. How can the COCOMO model be used to estimate the effort required to complete a software development project?



4. Effort is the amount of labour that will be required to complete a task. It is measured in person-months unit.

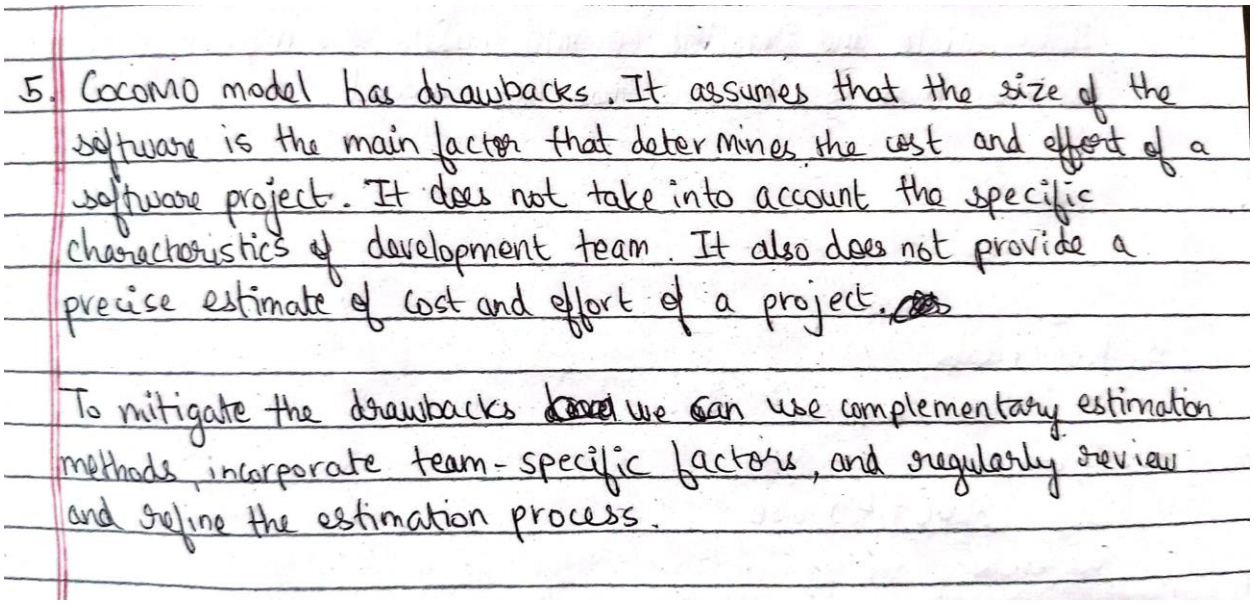
$$E = a(KLOC)^b$$

Here, E = Effort

KLOC = Estimated lines of code

a, b are constants having varying values for different models.

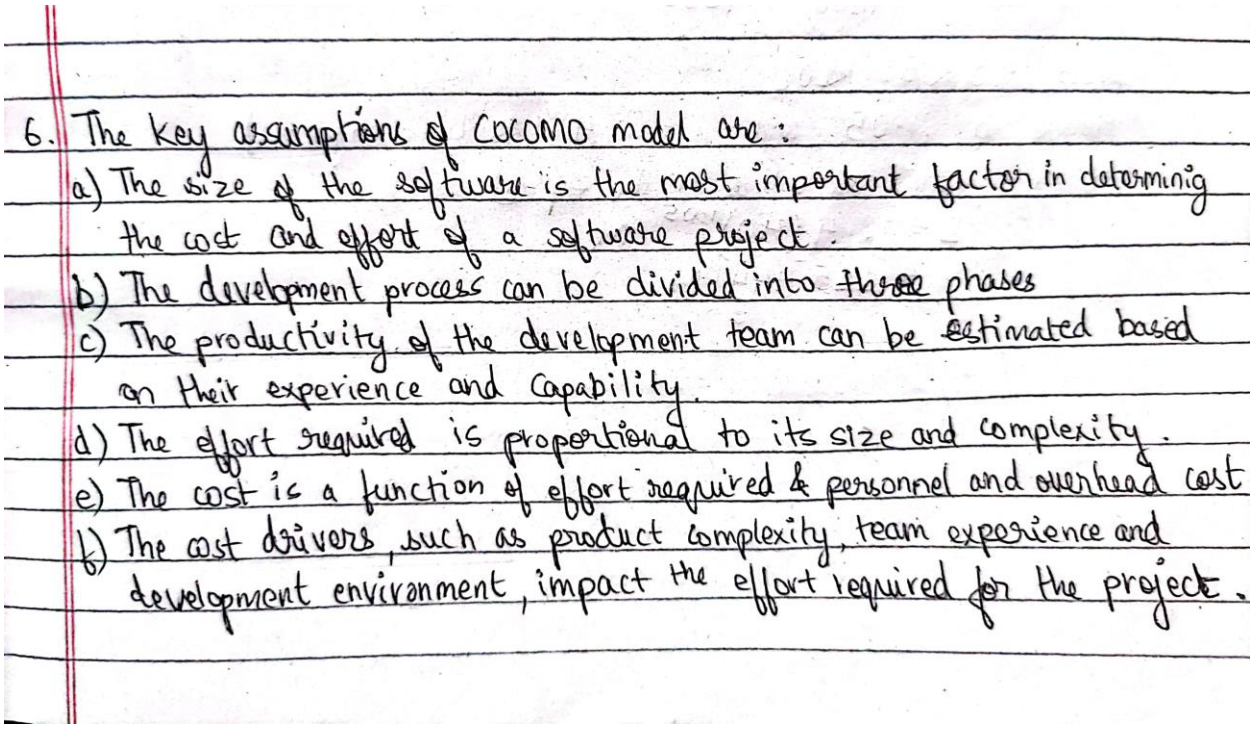
5. What are the limitations of the COCOMO model, and how can these be addressed or mitigated in practice?



5. Cocomo model has drawbacks. It assumes that the size of the software is the main factor that determines the cost and effort of a software project. It does not take into account the specific characteristics of development team. It also does not provide a precise estimate of cost and effort of a project.

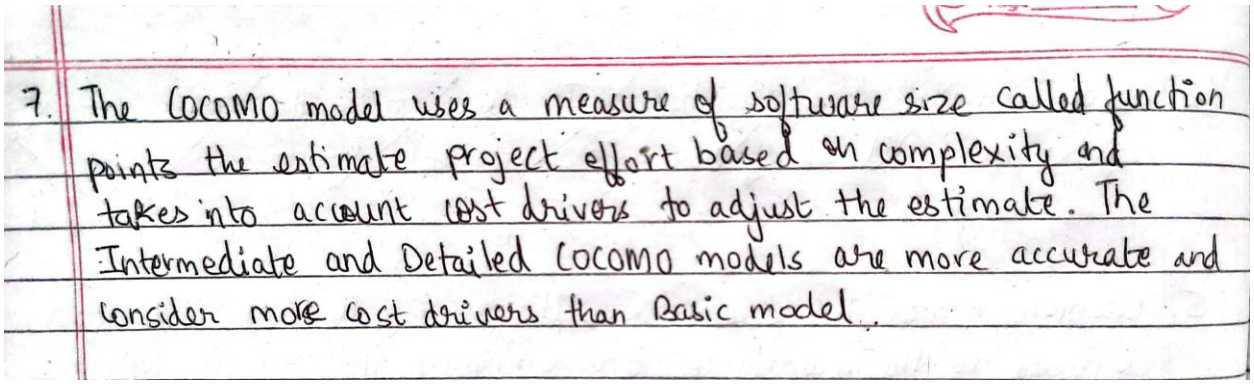
To mitigate the drawbacks we can use complementary estimation methods, incorporate team-specific factors, and regularly review and refine the estimation process.

6. What are the key assumptions of the COCOMO model?



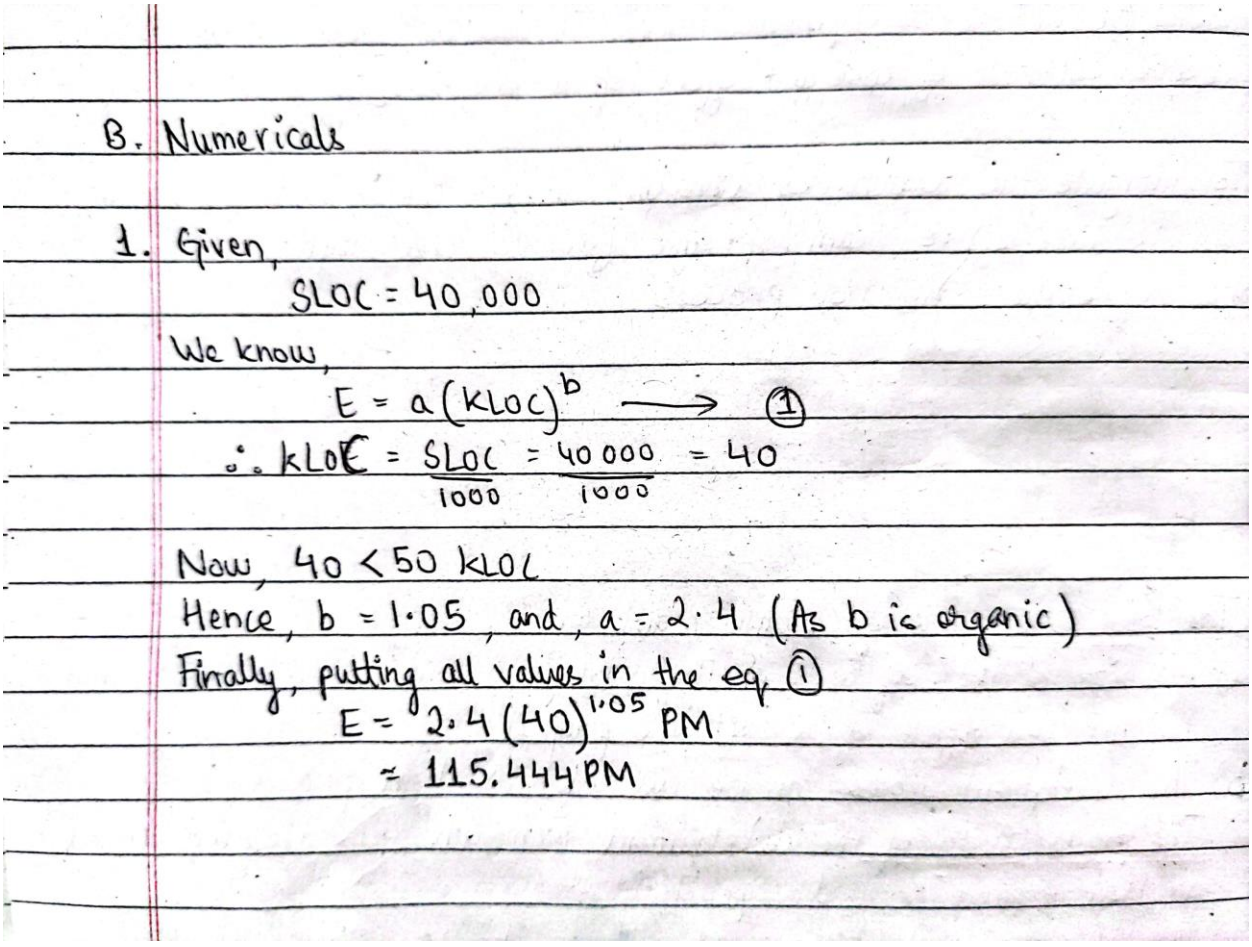
6. The key assumptions of COCOMO model are:
a) The size of the software is the most important factor in determining the cost and effort of a software project.
b) The development process can be divided into three phases
c) The productivity of the development team can be estimated based on their experience and capability.
d) The effort required is proportional to its size and complexity.
e) The cost is a function of effort required & personnel and overhead cost
f) The cost drivers, such as product complexity, team experience and development environment, impact the effort required for the project.

7. How does the COCOMO model account for differences between software projects in terms of size and complexity?

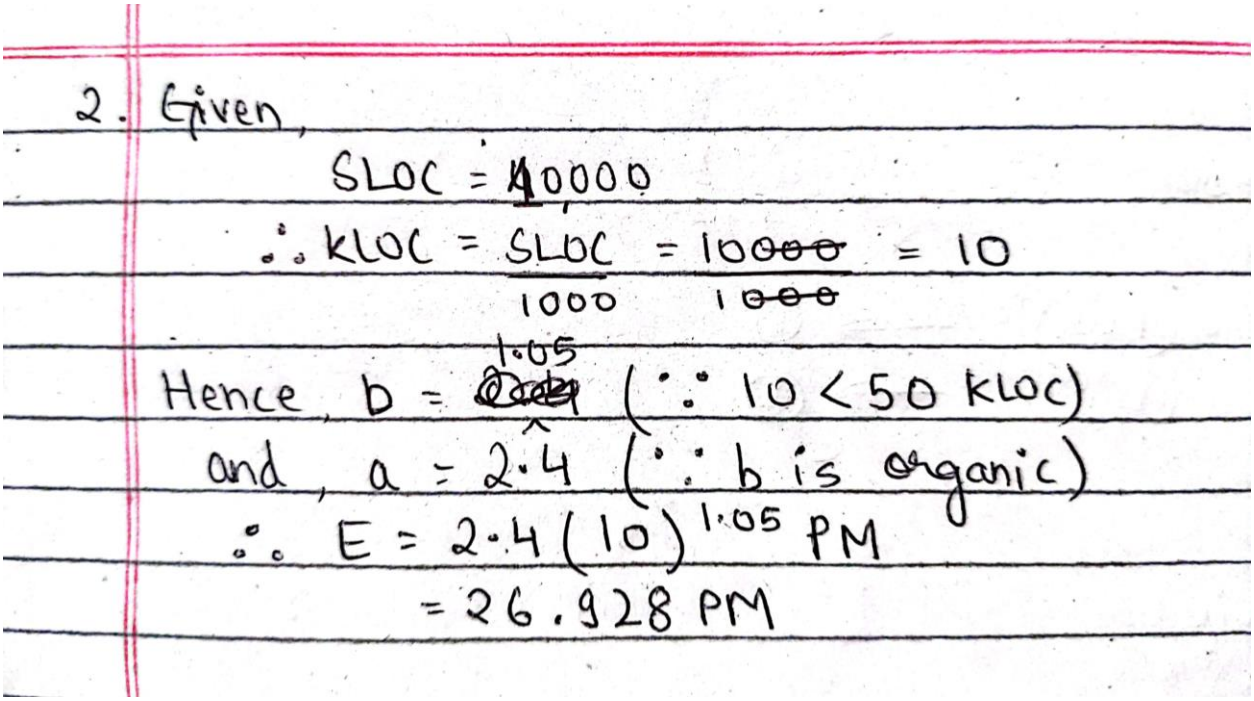


B. Numerical:

1. A software project has an estimated size of 40,000 lines of code. Using the Basic COCOMO model, estimate the effort required in person-months.



2. A software project has an estimated size of 10,000 lines of code. Using the Basic COCOMO model, estimate the effort required in person-months.



2. Given,

SLOC = 10,000

$\therefore KLOC = \frac{SLOC}{1000} = \frac{10000}{1000} = 10$

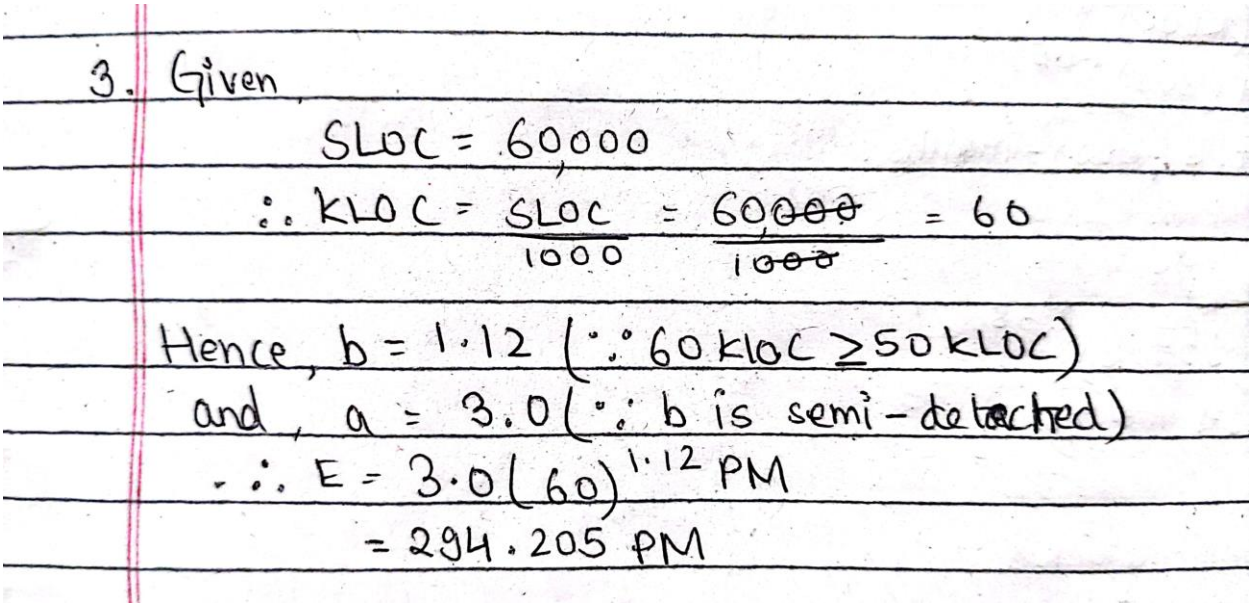
Hence, $b = 1.05$ ($\because 10 < 50$ KLOC)

and, $a = 2.4$ ($\because$ b is organic)

$\therefore E = 2.4(10)^{1.05}$ PM

$= 26.928$ PM

3. A software project has an estimated size of 60,000 lines of code. Using the Basic COCOMO model, estimate the effort required in person-months.



3. Given,

SLOC = 60,000

$\therefore KLOC = \frac{SLOC}{1000} = \frac{60000}{1000} = 60$

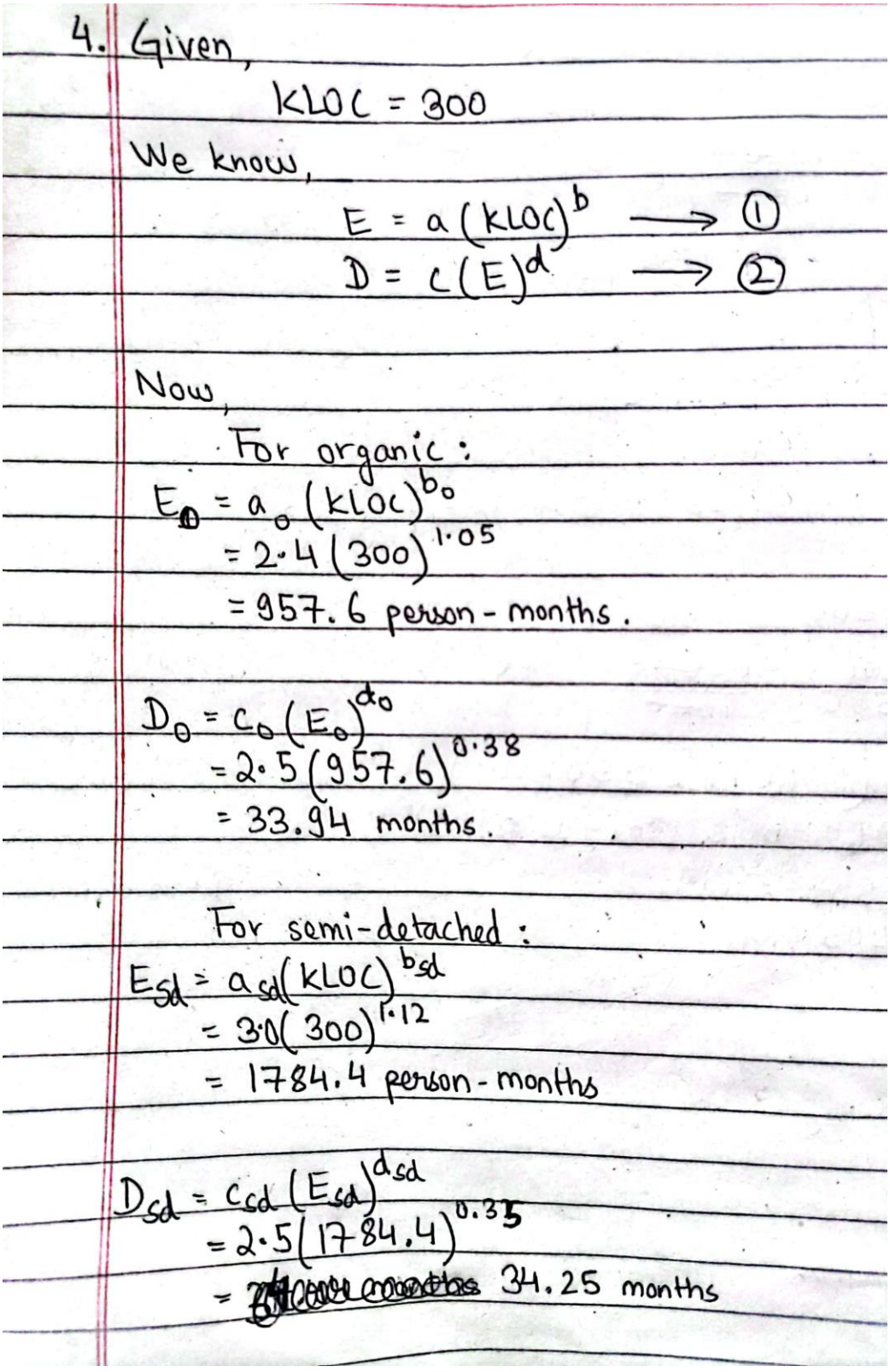
Hence, $b = 1.12$ ($\because 60$ KLOC ≥ 50 KLOC)

and, $a = 3.0$ ($\because$ b is semi-detached)

$\therefore E = 3.0(60)^{1.12}$ PM

$= 294.205$ PM

4. Estimate the effort and development time required for a software project with an estimated size of 300 KLOC using the three modes in the COCOMO model.



4. Given,

KLOC = 300

We know,

$E = a(KLOC)^b$ → (1)

$D = c(E)^d$ → (2)

Now,

For organic:

$E_o = a_o(KLOC)^{b_o}$

$= 2.4(300)^{1.05}$

$= 957.6$ person-months.

$D_o = c_o(E_o)^{d_o}$

$= 2.5(957.6)^{0.38}$

$= 33.94$ months.

For semi-detached:

$E_{sd} = a_{sd}(KLOC)^{b_{sd}}$

$= 3.0(300)^{1.12}$

$= 1784.4$ person-months

$D_{sd} = c_{sd}(E_{sd})^{d_{sd}}$

$= 2.5(1784.4)^{0.35}$

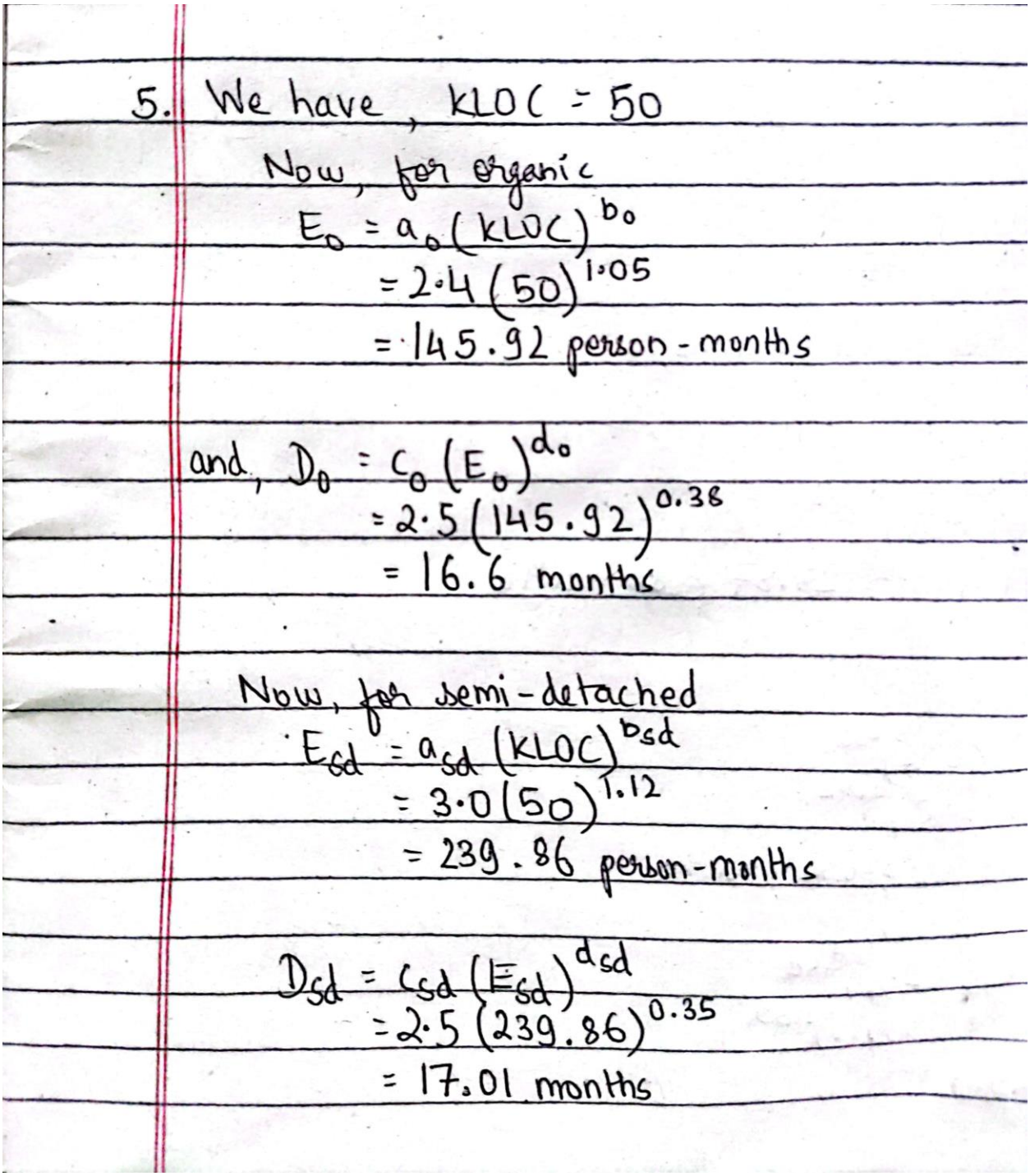
$= 34.25$ months

For embedded :

$$E_e = a_e (KLOC)^{b_e}$$
$$= 3.6(300)^{1.20}$$
$$= 3379.46 \text{ person-months}$$

$$D_e = c_e (E_e)^{d_e}$$
$$= 2.5(3379.46)^{0.32}$$
$$= 33.66 \text{ months}$$

5. A software project has an estimated size of 50 KLOC. Using the COCOMO model, calculate the effort and development time for each of the three modes: organic, semidetached, and embedded.



5. We have, KLOC = 50

Now, for organic

$E_o = a_o(KLOC)^{b_o}$

$= 2.4(50)^{1.05}$

$= 145.92$ person-months

and, $D_o = c_o(E_o)^{d_o}$

$= 2.5(145.92)^{0.38}$

$= 16.6$ months

Now, for semi-detached

$E_{sd} = a_{sd}(KLOC)^{b_{sd}}$

$= 3.0(50)^{1.12}$

$= 239.86$ person-months

$D_{sd} = c_{sd}(E_{sd})^{d_{sd}}$

$= 2.5(239.86)^{0.35}$

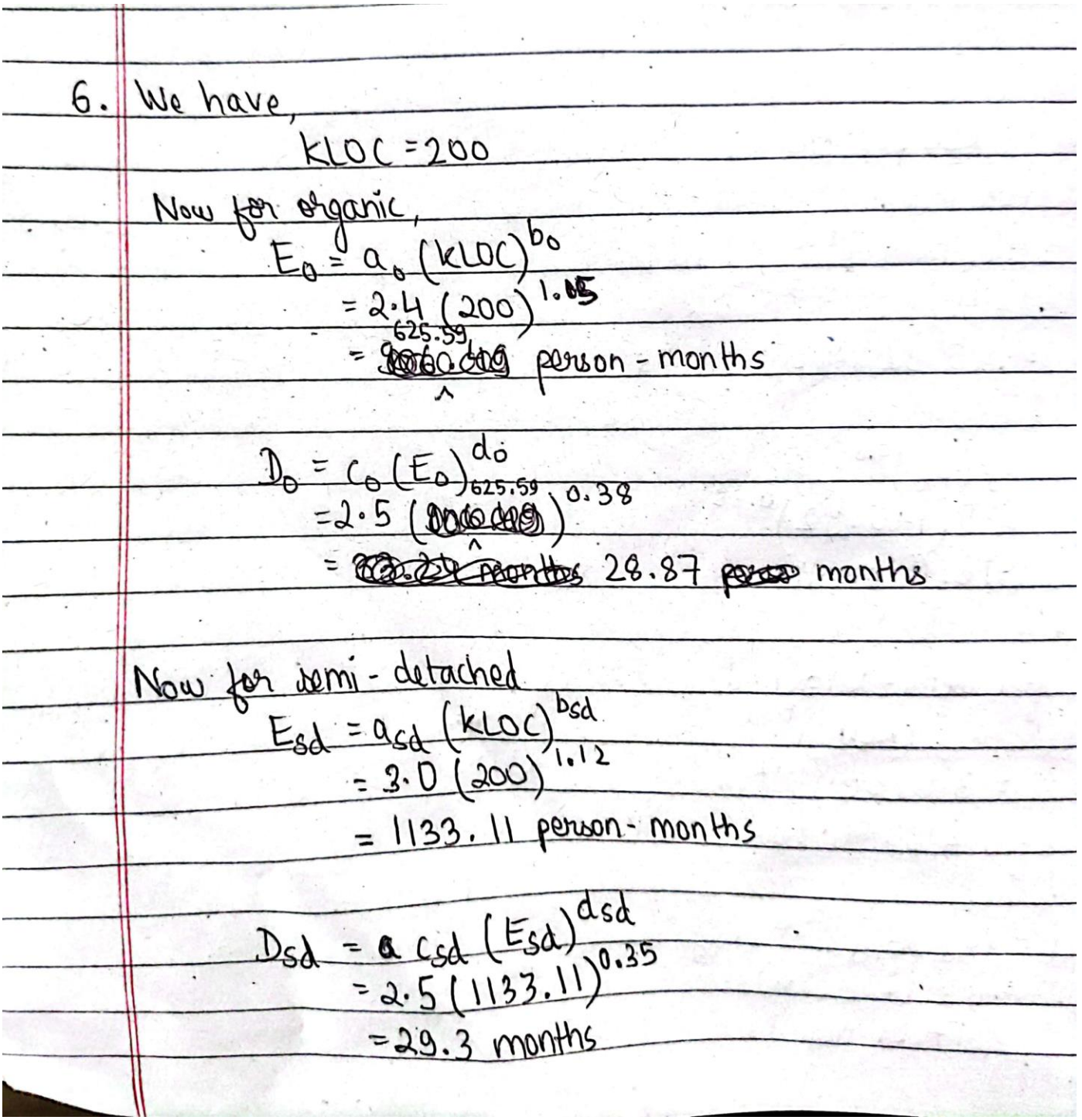
$= 17.01$ months

Now, for embedded

$$E_e = a_e (KLOC)^{b_e}$$
$$= 3.6(250)^{1.2}$$
$$= 393.61 \text{ person-months}$$

$$D_e = c_e (E_e)^{d_e}$$
$$= 2.5(393.61)^{0.32}$$
$$= 16.91 \text{ months}$$

6. A software project is estimated to be 200 KLOC in size. Using the COCOMO model, calculate the effort and development time for each of the three modes: organic, semidetached, and embedded.



6. We have,

KLOC = 200

Now for organic,

$E_o = a_o (KLOC)^{b_o}$

$= 2.4 (200)^{1.05}$

$= 625.59$ person-months

$D_o = c_o (E_o)^{d_o}$

$= 2.5 (625.59)^{0.38}$

$= 28.87$ months

Now for semi-detached

$E_{sd} = a_{sd} (KLOC)^{b_{sd}}$

$= 3.0 (200)^{1.12}$

$= 1133.11$ person-months

$D_{sd} = c_{sd} (E_{sd})^{d_{sd}}$

$= 2.5 (1133.11)^{0.35}$

$= 29.3$ months

For embedded,

$$E_e = a_e (KLOC)^{b_e}$$
$$= 3.6 (200)^{1.2}$$
$$= 2077.48 \text{ person-months}$$

$$D_e = c_e (E_e)^{d_e}$$
$$= 2.5 (2077.48)^{0.32}$$
$$= 28.81 \text{ months}$$