FIRST and LAST NAME: Student number:

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IT1: Software Product Lines

Final Exam
Individual, no document allowed, no computer
Each Multiple Choice Question can have 0, 1, 2, 3 or 4 correct answers
Circle the correct answers in a readable way

Thème 1: Introduction (5 points)

1. What is the main benefit of adopting software product lines? (0.5 pts)

A) Reduction of development costs
B) Increase in the number of bugs
C) Reduced product variability
D) Increased complexity of development processes

2. Which of the following is not a direct economic consequence of implementing software product lines? (0.5 pts)

A) Reduction of time-to-market
B) Increased customer satisfaction
C) Lower maintenance costs
D) Increased training costs

3. Which of the following statements are true about the business model of software product lines? (0.5 pts)

A) Reduced time required for new product development
B) Increase in upfront development costs
C) Reduction of long-term operational costs
D) Improvement of the overall quality of the products

4. What is the effect of product line engineering on the customer-supplier relationship in software development? (0.5 pts)

A) Increased customer dependency
B) Reduced flexibility to meet specific customer needs
C) Improved ability to respond quickly to customer requests
D) Decrease in the quality of the products delivered

5. Assume that the cost of developing an independent system is 100 units per system. If the initial cost to establish the product line platform is 200 units, and the cost of developing each subsequent system with the product line is reduced by 50%, how much will it cost to develop 4 systems using the product line? (1 point)

A) 400 units
B) 500 units
C) 600 units
D) 800 units

6. Based on the same scenario as the previous question, how many systems need to be developed with the product line for the costs to be equivalent to those of the independent development method? (1 point)

A) 3 systems
B) 4 systems
C) 5 systems
D) 6 systems

7. If the cost of developing an independent system is 120 units and the platform cost for the product line is 360 units with a cost reduction of 40% per system developed through the product line, what is the total cost of developing 3 systems with the product line? (1 point)

A) 7 units
B) 8 units
C) 504 units
D) 576 units

Theme 2: Notations and Domain Engineering (5 points)

1. What notation is specifically designed for modeling variability in software product lines? (0.5 points)

A) UML
B) FODA
C) BPMN
D) DRE

2. A 'dead feature' in a feature model of a software product line indicates:

A) A characteristic that is always selected
B) A Feature That Can Never Be Selected
C) An optional feature
D) A Mandatory Feature

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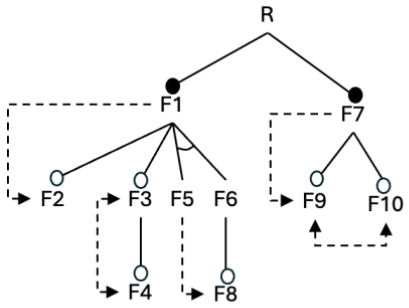
3. What is a 'full mandatory feature' in the context of software product lines?

A) A feature that is always optional
B) A Characteristic That Is Always Excluded
C) An optional feature that is always included in all configurations
D) A feature that has no impact on the final product

4. Which of the following defects are typical in the feature models of software product lines?

A) Dead features
B) Full mandatory features
C) Features without interdependencies
D) Features with Circular Constraints

The next 3 questions are about the feature model below (the F5/F6 alternative is an inclusive OR)



Contrainte supplémentaire : F2 => F8 OR F10

5. Which statement correctly reflects a constraint in this feature line model? (1 point)

A) If F2 is selected, then F4 must also be selected.
B) F5 and F6 can be selected together.
C) If F3 is selected, F4 cannot be selected.
D) If F2 is selected, then F8 or F10 must be selected.

6. Which of the following statements is contradictory to the constraints of the feature line model presented? (1 point)

A) F7 requires the selection of F9.
B) F1 can be selected without F2.
C) F8 can be selected with F5.
D) F9 and F10 cannot be selected together.

7. Which of the following statements does not reflect the constraints of the feature line model presented? (1 point)

A) F9 is a daughter characteristic of F7.
B) F2 and F3 are sister characteristics under F1.
C) If F2 is selected, F8 must be selected, but not F10.

D) F5 and F6 are alternatives.

Theme 3: Application Engineering (6 points)

1. In application engineering of software product lines, 'configuration' refers to (0.5 points):

A) Selection of characteristics for a specific product
B) Programming new features
C) Updating the basic assets of the product line
D) Management of development teams

2. What is 'derivation' in the context of application engineering? (0.5 points)

A) Creation of new features
B) Assembling a final product from the selected features
C) Analysis of client needs
D) Development of the core assets of the product line

3. What are the activities involved in the application engineering of software product lines? (0.5 points)

A) Development of core assets
B) Configuring Features for a Specific Product
C) Assembling the final product
D) Maintenance of existing products

4. What is the main purpose of application engineering in software product lines? (0.5 points)

A) Optimize system performance
B) Minimize production costs
C) Ensure Regulatory Compliance
D) Produce specific instances of configuration-based products

The next 3 questions relate to the feature line model proposed earlier.

4. Which of the following configurations is correct according to the feature line template? (1 point)

A) R, F1, F2, F3, F4
B) R, F1, F2, F6, F7, F8, F9
C) R, F1, F3, F5, F7, F10
D) R, F7, F9, F10

5. Suppose each characteristic has an associated cost: F1, F7 (1 unit each), F2, F3, F5, F6, F9, F10 (0.5 units each), and F4, F8 (0.25 units each). What is the least expensive configuration that meets all constraints and includes F1, F7, and F6? (1 point)

A) R, F1, F2, F6, F7, F8, F9
B) R, F1, F2, F6, F7, F9
C) R, F1, F2, F6, F7, F8, F10
D) R, F1, F6, F7, F9, F10

6. Considering that F2 should always be included if F1 is selected, how many valid configurations are possible that include F7 but exclude F10? (1 point)

A) 4
B) 6
(C) 8
(D) 10

8. Considering that F2 should always be included if F1 is selected, give a list of possible valid configurations that include F7 but exclude F10 (no need to include the root R)? (1 point)

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Theme 4: Personnal analysis (4 points)

The chapter 10 "Domain Engineering" of the Book "*Software product line engineering: foundations, principles, and techniques*" (Pohl's et al. Springer, 2005) introduces the concept of "*application-requirements matrix*" as follows:

"The application–requirements matrix (see Table 10-1 for an example) gives an approximation of the commonality (and also of the variability) for a given set of software product line application requirements. The application–requirements matrix details the product roadmap, which typically defines common and variable features at a higher level of abstraction. The left column of the matrix lists the requirements of the considered applications. The applications themselves are listed in the top row. In the body of the matrix it is marked for which application a certain requirement is mandatory. »

Table 10-1: Structure of an application–requirements matrix for four applications

Application Requirements	App. 1	App. 2	App. 3	App. 4
R1	mandatory	mandatory	mandatory	mandatory
R2	-	-	mandatory	mandatory
R3	-	mandatory	-	-
…	…	…	…	…

Explain below how to use an application-requirement matrix to build a product line model. Illustrate with an example if needed