PROBLEM 1. [3 × 2 = 6 MARKS] [WORD LIMIT = 10 PER PART]

(SWEBOK3: Chapter 1: Software Requirements.)

(a) State which, if any, of the following is NOT a means for Validation of Software Requirements: Prototyping, Conceptual Modeling, Reviews, Acceptance Testing.
(b) Fill in the blank in the following: A software requirement that cannot be addressed by a single component but depends on how all the software components interoperate is called _____.
(c) The software requirements can be classified into functional and non-functional categories. Give TWO other ways of classifying software requirements.

SOLUTION.

a) CONCEPTUAL MODELING AND PROTOTYPING X -1

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b) EMERGENT PROPERTY

c) (1) PRODUCT AND PROCESS REQUIREMENTS
(2) SYSTEM AND SOFTWARE REQUIREMENTS

PROBLEM 2. [5 × 2 = 10 MARKS] [WORD LIMIT = 1 PER PART]

Let S1, S2, and S3 be the only stakeholders for some project P. Let P correspond to a software system M. State whether the following are TRUE or FALSE. (There is no need for an explanation.) **An INCORRECT CHOICE carries –1 mark. However, if the TOTAL marks for the problem are negative, then they are converted to a 0.**

(a) If S1 is not an organization, then S1 must be an individual.
(b) If S1 is not a negative stakeholder, then S2 or S3 must be a negative stakeholder.
(c) If M has a sub-system M1, then M1 could be one of S1, S2, or S3.
(d) If S1 `Collaborates-With` S2, then it can be concluded that S2 `Collaborates-With` S1.
(e) If both S2 and S3 have the same priority "Major" on the Influence-Importance Diagram, then this implies that S2 is as Important as S3.

SOLUTION.

a) FALSE
b) ~~FALSE~~ TRUE
c) FALSE
d) TRUE
e) FALSE

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PROBLEM 3. [4 × 2 = 8 MARKS] [WORD LIMIT FOR EACH PART = 2]

Let there be arbitrary classes with names C_1, C_2, C_3, . . . Let R_1, R_2, R_3, . . . be one of the relationship types in UML (association, aggregation, composition, or generalization). In a problem domain model expressed in UML, indicate the statements in the following that are POSSIBLE and the ones that are NOT POSSIBLE. (There is no need for an explanation.) **An INCORRECT CHOICE carries –1 mark. However, if the TOTAL marks for the problem are negative, then they are converted to a 0.**

(a) C_1 R_1 C_1, where R is the association relationship.

(b) $(R_1\ C_1\ R_1) \vee (R_1\ C_2\ R_1)$, where $\vee$ is the "logical or", and R_1 is any type of relationship.

(c) $(C_1\ R_1\ C_2) \wedge (C_2\ R_2\ C_3)$, where $\wedge$ is the "logical and", R_1 is the aggregation relationship (direction left to right), and R_2 is the composition relationship (direction right to left).

(d) If C_1 R C_2, then C_2 R C_1, where R is the association relationship.

SOLUTION.

a) POSSIBLE.

b) NOT POSSIBLE

c) NOT POSSIBLE

d) POSSIBLE

PROBLEM 4. [2 × 3 = 6 MARKS] [WORD LIMIT = NOT APPLICABLE]

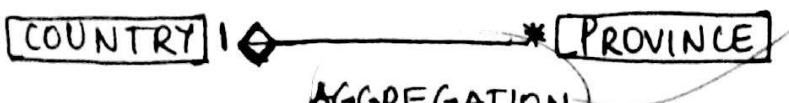
For each of the following pairs of concepts, construct one of possible types of relationships in UML (association, aggregation, composition, or generalization) that exist between them. In each case, make sure that your construction is expressive.

(a) Country Province

(b) Doctor HospitalBuilding

SOLUTION.

a)



(Aggregation)

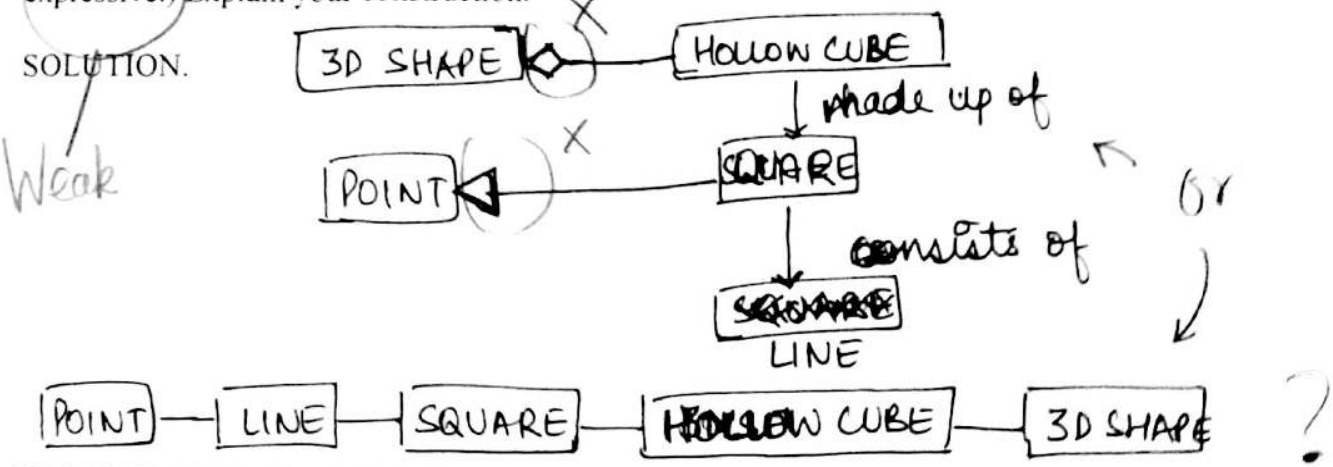
Cadinality

b)

PROBLEM 5. [4 MARKS] [WORD LIMIT = NOT APPLICABLE]

Let the concepts HollowCube, Line, Point, Square, and 3DShape be given. Using UML, construct a problem domain model using minimum number of constructs. (There is no need to expose the details of any of the concepts, but your construction must be expressive.) Explain your construction.

SOLUTION.



PROBLEM 6. [5 × 2 = 10 MARKS] [WORD LIMIT FOR EACH PART = 15]

Let UCM be an arbitrary use case model expressed in UML. Let UC be a named use case in UCM. Let A_1 and A_2 be the only named actors in UCM. State whether the following statements are TRUE or FALSE. Explain.

(a) UC must have at least one recovery scenario.
(b) It is not possible that $A_1 = A_2$.
(c) If A_1 is not a primary actor, then A_2 must be a secondary actor.
(d) It is not possible that A_2 ---<<extend>>--> A_1.
(e) If A_1 does not generalize to A_2, then A_2 must generalize to A_1.

SOLUTION.

a) FALSE Use case model can have zero or more recovery scenario. i.e not temporally ordered.

b) FALSE. If redundancy is introduced then A_1 can be equal to A_2 i.e semantically.

c) FALSE. A use case model can have one or more primary actors. or must ?
$|A_p| \geq 1$

d) TRUE The only relationship exists between actors is generalization. (to generalize)

e) TRUE Because If A_2 generalize to A_1 then A_1 specialize A_2 Generalization exists.

PROBLEM 7. [2 × 3 = 6 MARKS] [WORD LIMIT FOR EACH PART = 30]

Let UCM be an arbitrary use case model expressed in UML. Let UC_1 and UC_2 be use cases, `--<<include>>-->` denotes the include relationship, `--<<extend>>-->` denotes the extend relationship, and $\wedge$ denotes the logical "and".

If the following is possible, give an example; if not possible, provide an explanation.

(a) There is a use case model with

$[\ UC_1$ `--<<include>>-->` $UC_2\ ] \wedge [\ UC_2$ `--<<include>>-->` $UC_1\ ]$

(b) There is a use case model with

$[\ UC_1$ `--<<include>>-->` $UC_2\ ] \wedge [\ UC_2$ `--<<extend>>-->` $UC_1\ ]$

SOLUTION.

a) NOT POSSIBLE.
because if instances of UC_1 must include UC_2 then it is ~~not~~ include relationship and instances of UC_2 must not include the instances of UC_1.
Weak

b) POSSIBLE.
It is possible that instances of UC_1 include the instances of UC_2 and instances of UC_2 extends the instance/behavio of UC_1. Include is mandatory whereas extend is optional