Systems Engineering and Project Management
VO 716.111

Exam, List of possible questions

Group A

Name	Matrikelnr.	Kennzahl

Before starting the exam please fill in your name, the Matrikelnummer (your student number), and the Kennzahl (the number of your study program). Do not use your own sheets of paper. Write the solution directly at the given free space of this test. You can answer the questions either in German or English.

Grades:
0. . . 25   Nicht genügend (5)
26. . . 32   Genügend (4)
33. . . 38   Befriedigend (3)
39 . . . 44   Gut (2)
45. . . 50   Sehr gut (1)

1. *Introduction:* (Max. 10 points)

   Answer the following questions (where each question counts 2 points):

   (a) What is a *system*?
       Solution:

   (b) What are common characteristics of *systems*?
       Solution:

   (c) What is a *system* accordingly to IEEE Std 1220-1998?
       Solution:

   (d) What is a *system* accordingly to ISO/IEC 15288:2008?
       Solution:

   (e) What do *systems* have?
       Solution:

   (f) How can *systems* be described?
       Solution:

(g) What is *engineering*?
Solution:

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(h) What is *systems engineering*?
Solution:

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(i) Which areas / disciplines are related to *systems engineering*?
Solution:

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(j) What are the three most important tasks of *systems engineering*?
Solution:

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(k) Listen the 2 different types of models used in simulation.
Solution:

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(l) What is the main objective of *safety engineering*?
Solution:

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(m) How is *risk* defined?
Solution:

(n) What are the two techniques introduced in the lecture for risk assessment?
Solution:

(o) What are consequences of not well designed systems?
Solution:
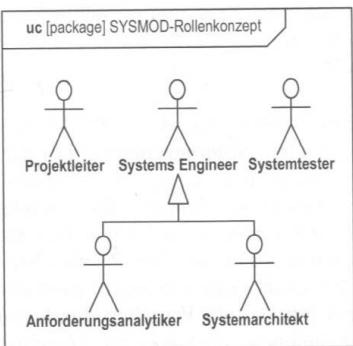
2. *Modeling process:* (Max. 10 points)

Answer the following questions (where each question counts 2 points):

(a) What are the foundational ideas behind SYSMOD?

Solution:

(b) Given the following role concept of SYSMOD. What are the different roles of systems engineers for?

Solution:

(c) What are the 6 tasks of SYSMOD?

Solution:

(d) What is a project notebook / Projekttagebuch ?

Solution:

(e) What is the difference between a project notebook and a meeting protocol?

Solution:

(f) Which information should always be part of a meeting protocol?
Solution:

(g) What is always the reason for starting systems engineering?
Solution:

(h) What should requirements never describe?
Solution:

(i) What is the difference between a requirement and a potential solution?
Solution:

(j) Name some questions to be answered when outlining the system's ideas and objectives?
Solution:

(k) What are the subgoals of requirements engineering in SYSMOD?
Solution:

(l) Why are stakeholders so important in systems engineering?
Solution:

(m) What is the system context and why is it important?
Solution:
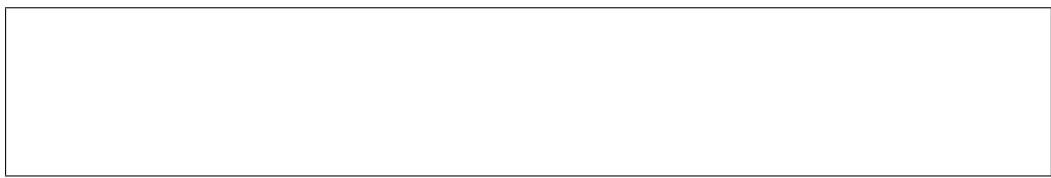
(n) What is a use case?
Solution:

(o) Which SYSML diagram is used for describing the system's structure?
Solution:

(p) Why are state diagrams important in SYSMOD?
Solution:

3. *UML:* (Max. 10 points)

   Answer the following questions (where each question counts 2 points):

   (a) What are the objectives behind UML?
   Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

   (b) Is it necessary to use all UML diagram types for describing a system?
   Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   └───┘

   (c) What is an *object* in UML?
   Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

   (d) What are the properties of an UML object?
   Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

   (e) What is encapsulation?
   Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

(f) What is a class in UML?
Solution:
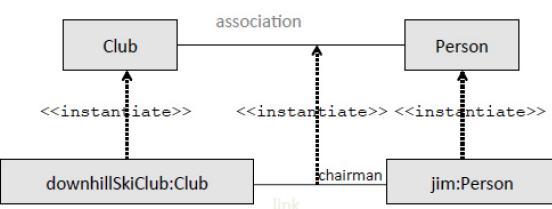
(g) What are relationships in UML?
Solution:

(h) What are associations in UML?
Solution:

(i) Describe the content stated in the following UML diagram.
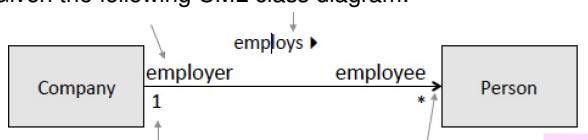
Solution:

(j) What information do associations have?
Solution:

(k) Given the following UML class diagram:
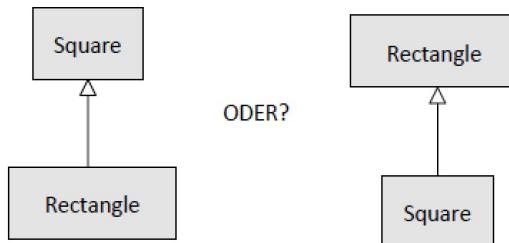
Describe the content of this diagram using your own words. Can this class diagram be used for describing informations to be handled at social security organizations or the ministry of finance? If not, explain the reason.

Solution:

(l) What is inheritance? What are the principles behind inheritance?
Solution:

(m) Which of the following inheritance relationship diagrams is the correct one, the left or the right?

Solution:

(n) What is polymorphism?

Solution:

(o) What is a component in UML?

Solution:
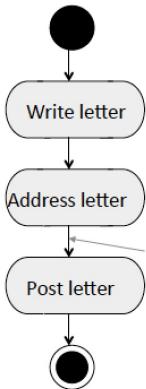
(p) What is the purpose of a UML deployment diagram?

Solution:

(q) What are UML use cases and what are they describing?
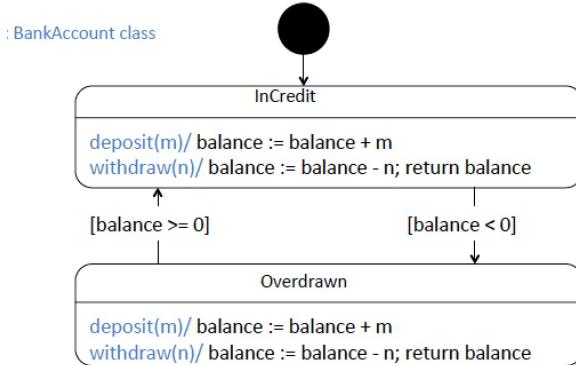
Solution:

(r) From which type of UML diagram is the following figure?

Solution:

┌──┐
│   │
│   │
│   │
│   │
│   │
└──┘

(s) What is described in the following diagram? What type of UML diagram is used?

: BankAccount class

InCredit

deposit(m)/ balance := balance + m
withdraw(n)/ balance := balance - n; return balance

[balance >= 0]   [balance < 0]

Overdrawn

deposit(m)/ balance := balance + m
withdraw(n)/ balance := balance - n; return balance

Solution:

┌──┐
│   │
│   │
│   │
│   │
│   │
│   │
└──┘

(t) Name at least 4 structure diagrams in UML?
Solution:

┌──┐
│   │
│   │
│   │
│   │
│   │
│   │
│   │
│   │
└──┘

(u) Name at least 4 behavior diagrams in UML?
Solution:

┌──┐
│   │
│   │
│   │
│   │
│   │
│   │
│   │
└──┘

4. *SYSML:* (Max. 10 points)

   Answer the following questions (where each question counts 2 points):

   (a) What is SYSML?
       Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   └───┘

   (b) What are the differences between UML and SYSML?
       Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘
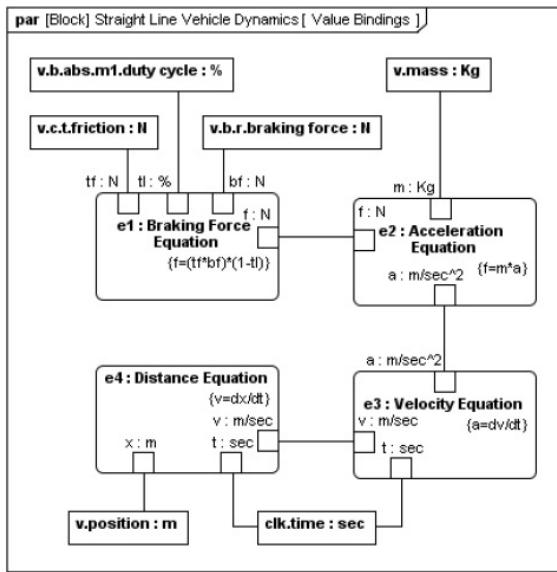
   (c) What is the difference between a block definition diagram and an internal block diagram in SYSML?
       Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

   (d) What are parametric diagrams in SYSML?
       Solution:

   ┌───┐
   │   │
   │   │
   │   │
   │   │
   │   │
   └───┘

   (e) Explain the content given in the following diagram using your own words.

par [Block] Straight Line Vehicle Dynamics [Value Bindings]

v.b.abs.m1.duty cycle : %

v.mass : Kg

v.c.t.friction : N

v.b.r.braking force : N

tf : N   tl : %   bf : N   m : Kg

e1 : Braking Force Equation
{f=(tf*bf)*(1-tl)}
f : N

e2 : Acceleration Equation
a : m/sec^2   {f=m*a}

a : m/sec^2

e4 : Distance Equation
{v=dx/dt}
v : m/sec

e3 : Velocity Equation
v : m/sec   {a=dv/dt}
t : sec

x : m   t : sec

v.position : m

clk.time : sec
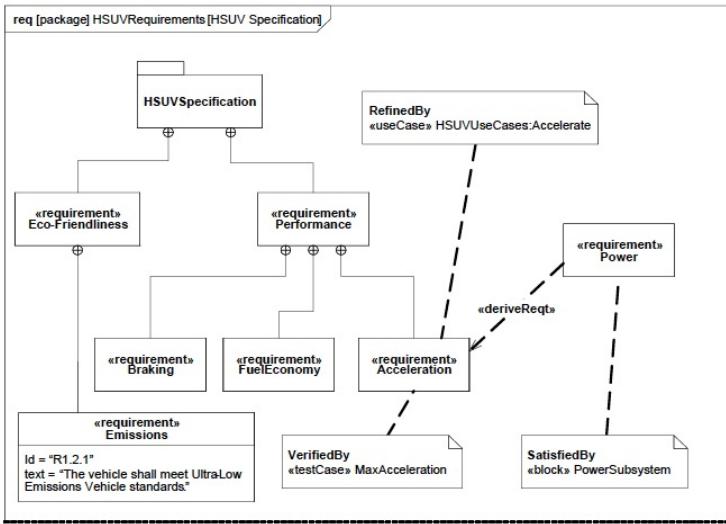
Solution:

(f) What are requirements diagrams in SYSML?
    Solution:

(g) Are requirement diagrams also part of UML?
    Solution:

(h) Describe the content given in the following requirement diagram using your own words.

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req [package] HSUVRequirements [HSUV Specification]

HSUVSpecification

«requirement» Eco-Friendliness

«requirement» Performance

«requirement» Braking

«requirement» FuelEconomy

«requirement» Acceleration

«requirement» Power

«requirement» Emissions
Id = "R1.2.1"
text = "The vehicle shall meet UltraLow Emissions Vehicle standards."

RefinedBy
«useCase» HSUVUseCases:Accelerate

«deriveReqt»

VerifiedBy
«testCase» MaxAcceleration

SatisfiedBy
«block» PowerSubsystem

Solution:

(i) What is an requirement and what should be avoided when describing requirements?
Solution:

5. *Project management:* (Max. 10 points)

Answer the following questions (where each question counts 2 points):

(a) What characterizes a project?

Solution:

(b) What is a project?

Solution:

(c) What is a project specific organization?

Solution:

(d) What are the tasks of the project leader?

Solution:

(e) Why is project management and planning necessary?

Solution:

(f) What are the phases of a project?
Solution:

(g) What is the purpose of a project plan? What has to be included?
Solution:

(h) What are the different methods for cost and effort estimation?
*Solution:*
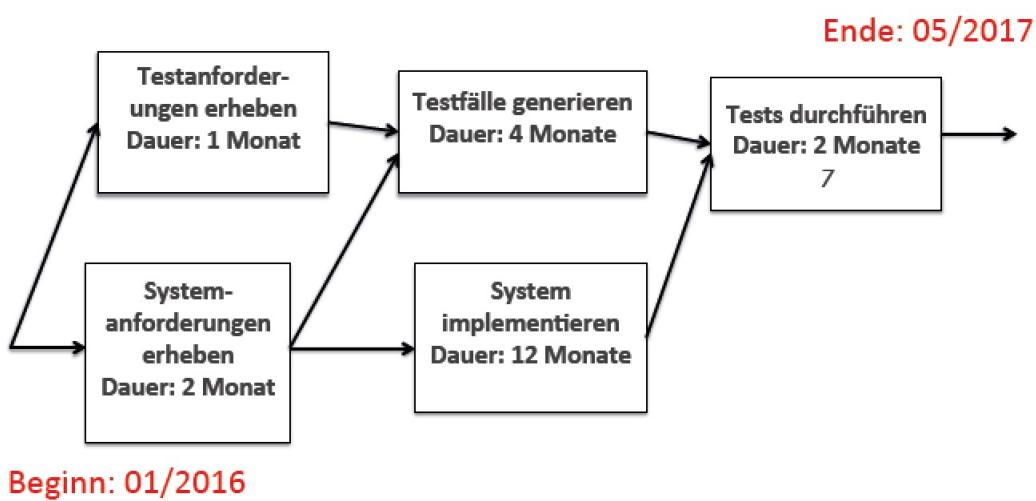
(i) What is the Cone of Uncertainty"?
Solution:

(j) What are the different steps of project planing?
Solution:
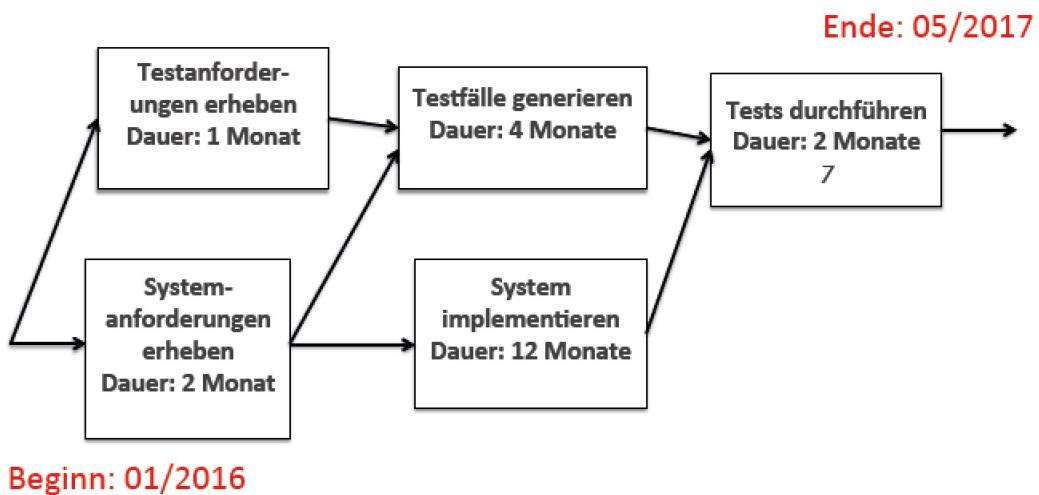
(k) Compute the begin and end dates for each activity using forward calculation for the following project plan:

Ende: 05/2017

Testanforder-ungen erheben Dauer: 1 Monat	**Testfälle generieren** Dauer: 4 Monate	**Tests durchführen** Dauer: 2 Monate *7*	
System-anforderungen erheben Dauer: 2 Monat	**System implementieren** Dauer: 12 Monate		

Beginn: 01/2016

Solution:

(l) Compute the begin and end dates for each activity using backward calculation for the following project plan:

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Ende: 05/2017

| Testanforder-ungen erheben Dauer: 1 Monat |
| Testfälle generieren Dauer: 4 Monate |
| Tests durchführen Dauer: 2 Monate 7 |
| System-anforderungen erheben Dauer: 2 Monat |
| System implementieren Dauer: 12 Monate |

Beginn: 01/2016

Solution:

(m) What are milestones?
Solution:

(n) What are critical paths?
Solution: