

First Name..... Last Name.....

Sample Entrance Exam



TECHNISCHE
UNIVERSITÄT
DARMSTADT

Entrepreneurship and Innovation Management M. Sc.
Logistics and Supply Chain Management M. Sc.

Department of Law and Economics
TU Darmstadt

Winter Term 2020/2021

Important notes

- Please verify the completeness of your copy! This exam comprises **15 pages** and **9 assignments**.
- Please start your exam by filling in your **name** on **every page** of the exam.
- **Do not take your copy into pieces – keep it stapled!**
- Do not use any other paper than the exam. In case you need additional space, use the backside of the exam or ask for an additional empty page.
- The exam has a duration of 90 minutes.
- Except for a pocket calculator, no other auxiliaries are allowed.
- **Please note: Exercises 8 and 9 are mutually exclusive alternatives! Applicants to the LSCM program have to answer exercise 8, applicants to the EIM program have to answer exercise 9!**

Good luck with your exam!

First name	Last name
Program applied for (LSCM, EIM)		

Assignment	Points available	Points achieved
1	20 points	
2	10 points	
3	10 points	
4	10 points	
5	10 points	
6	10 points	
7	10 points	
8 / 9	10 points	
Total	90 points	

Entrance Exam passed	
Entrance Exam failed	

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1 Exercise 1 (20 Points)

1.1 The bargaining power of suppliers is one force of Porter's Five Forces model for industry structure analysis. Explain two conditions for which the bargaining power of suppliers is particularly high. (3 points)

1.2 Explain the differences between strategic and operative planning. (2 points)

1.3 Distinguish the characteristics of consumer goods and services. (2 points)

1.4 Explain what market share, market potential, and market volume mean, and specify the formula for calculating the market share. (3 points)

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1.5 Assume that the demand x for a product is related to the price p :

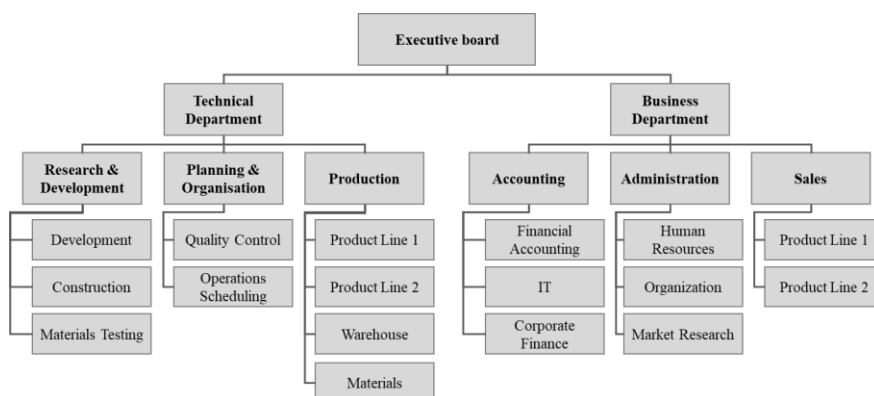
$$x(p) = 10,000 - 50p$$

Calculate and interpret the price elasticity of demand at a price of 0 EUR and at a price of 100 EUR. (4 points)

1.6 Explain the characteristics of "management by objectives". (2 points)

1.7 You are consulting the reorganisation of tuTIM AG. tuTIM AG provides you with the following organisational chart describing their current organisational structure. You receive additional information from management that approximately 70% of total turnover is generated from sales of materials.

What organisational disadvantages are evident from the organisational chart of tuTIM AG? Focus on two disadvantages and explain why each is a disadvantage. For each disadvantage, also give a suggestion for improvement. (4 points)



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2 Exercise 2 (10 Points)

2.1 Define the term equity. Explain two exemplary functions of equity for a company. (3 points)

2.2 You are offered to purchase a machine for **10,000 EUR**. You can use it for **4 years** (residual value = **5,000 EUR**). Each year, the machine will generate a revenue of **4,500 EUR**. The cost to operate the machine (per year) is **2,500 EUR** in the first two years and **3,000 EUR** in years three and four.
Calculate the net present value of this investment at a market interest rate of 2 percent. (4 points)

2.3 Assume that the Cash Ratio of Company A is **0.3**. Explain how the cash ratio is calculated and interpret the cash ratio of Company A. (3 points)

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3 Exercise 3 (10 Points)

3.1 Heinzl SE produces three types of breathing masks: "Classic", "Fancy", and "Technic". "Classic" sells for **5 EUR/unit** and has variable costs of **1 EUR/unit**. "Fancy" sells for **10 EUR/unit** and has variable costs of **4 EUR/unit**. "Technic" sells for **15 EUR/unit** and has variable costs of **7 EUR/unit**. Heinzl SE only sells bundles of 10 units of "Classic", 5 units of "Fancy", and 2 units of "Technic" to wholesalers (i. e., the sales mix ratio of "Classic" : "Fancy" : "Technic" is **10 : 5 : 2**). For the current period, Heinzl SE has fixed costs of **17,200 EUR**. Assume the bundle/sales mix ratio is maintained for the following calculations.

Please calculate the contribution margin for one unit of each type of breathing masks and for one bundle/sales mix. How many units of each type does Heinzl SE need to sell to break even? (5 points)

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3.2 Alpha SE, a wholesale company, uses the FiFo (First in First out) method for the valuation of inventory. The table below shows the development of inventory for the fiscal year (ending December 31st).

Please calculate the

- 1. Costs of goods sold (for the months April, August, September and the whole year)**
- 2. Quantity of the closing inventory**
- 3. Composition and total value of the closing inventory.**

(5 points)

Month	Transaction type	Quantity	Costs per unit
January	Initial inventory	200	200 EUR
March	Purchased	200	250 EUR
April	Sold	200	
June	Purchased	500	470 EUR
July	Purchased	100	300 EUR
August	Sold	450	
September	Sold	100	
November	Purchased	300	200 EUR
December	Closing inventory		

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4 Exercise 4 (10 Points)

4.1 Visualize the following Euclidean algorithm for determining the greatest common divisor of two positive integers in an UML activity diagram. The UML activity diagram should contain the input of the variables x and y and the output of the result. (4 points)

The algorithm can be described as follows:

As long as x is not equal to y, repeat:
 If x is greater than y, then:
 subtract y from x and assign the result to x.
 Else:
 subtract x from y and assign the result to y.
If x is equal to y, then:
 x (or y) is the largest common divisor.

4.2 In the programming language Java, what is the meaning of overriding a method? In which context is it possible to override methods? (2 points)

4.3 In a zoo, several animals are to be moved to new housing areas. To plan the relocation, please write down Java code that implements the class that is described below. (4 points)

Define an abstract class Animal. This class has a public attribute mammal. The attribute is used to specify whether the animal in question is a mammal or not. The attribute is to be assigned a Boolean value using a constructor. The class Animal also defines an abstract public method determineHousing(). The method should later be used in a subclass to find a suitable housing for the respective animal. The method should return the number of the corresponding enclosure. The method does not expect a parameter.

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5 Exercise 5 (10 Points)

The Phillips curve, the natural rate of unemployment, and inflation

Let π denote the inflation rate, and π^e denote the expected inflation rate. The unemployment rate at time t is denoted by u_t . Suppose that the Phillips curve is given by

$$\pi_t = \pi_t^e + 0.2 - 2u_t.$$

5.1 What is the natural rate of unemployment? Explain the term Non-Accelerating Inflation Rate of Unemployment (NAIRU). (4 points)

5.2 Suppose that the rate of unemployment is equal to $u_0 = 10\%$ and that the inflation rate is 0% initially in **year $t=1$** . The authorities decide to bring the unemployment rate down to 5% and hold it there forever. **Determine the rate of inflation in year $t=3$ for the two cases (i) and (ii). (6 points)**

- i. Assume that inflation expectations are formed according to $\pi_t^e = 0.9 \pi_{t-1}$.
 - ii. Assume that inflation expectations are formed according to $\pi_t^e = 0$.
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6 Exercise 6 (10 Points)

Please insert your solutions into the boxes at the right side.

6.1 Descriptive statistics:

Given a univariate data series (1, 5, 4, 9, 3, 2) compute the following statistics: (2 points)

- a) Sample variance
- b) 0.5 quantile

6.2 Probability:

Given a fair dice with random outcomes $X \in \{1, \dots, 6\}$ and a fair coin with outcomes $Y \in \{1, 2\}$, compute the following probabilities: (3 points)

- a) $P(X \leq 4 \cap Y = 2)$
- b) $P(X + Y \leq 3)$
- c) $P(X = 5 | Y = 1)$

6.3 Random Variables:

Given the random variable X with cumulative distribution function $F(x) = \frac{1}{2}x$ for $0 \leq x \leq 2$, compute the following quantities: (2 points)

- a) Maximum value of the density function
- b) $E(X)$

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6.4 Inductive Statistics:

Compute the maximum likelihood estimator of the parameter θ for a random sample of n exponentially distributed observations $y_1, \dots, y_n \geq 0$ with density function $f(y_i) = \theta \exp(-\theta y_i)$.
(3 points)

Space for your derivation ...

Compute the estimator for the sample $y_1 = 2, y_2 = 4, y_3 = 3, y_4 = 7$.

7 Exercise 7 (10 Points)

7.1 What does the principle of private autonomy mean? Explain the term and name three aspects of this principle. (4 points)

7.2 What is meant by corporate social responsibility? (6 points)

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NOTE: Depending on your application, please only answer either exercise 8 (for applicants to the program "Production & Supply Chain Management") or exercise 9 (for applicants to the program "Entrepreneurship & Innovation Management")!

8 Exercise 8 (10 Points, only for LSCM applicants)

Sample Exam includes additional exercises for practicing – PSCM part in regular exam only includes 10 points

8.1 At your first day as an intern, you are faced with the following decision problem. You are given the below decision matrix with four alternatives a_i ($i = 1, \dots, 4$) and three scenarios s_j ($j = 1, \dots, 3$) with their respective probabilities of occurrence p_j (for exercises a)-d)).

Evaluate the scenarios using the following decision criteria: (17 points)

- a) Expected values (2.5 points)
- b) Variance/standard error (2.5 points)
- c) Semivariance (2.5 points)
- d) Preference function: $\Phi(\mu, \sigma) = 6\mu + 3\sigma$ (2.5 points)
- e) Maximin criterion (1 point)
- f) Maximax criterion (1 point)
- g) Laplace criterion (2.5 points)
- h) Hurwicz rule ($\lambda=0,5$) (2.5 points)

p_j	0,4	0,25	0,35
	s_1	s_2	s_3
a_1	4	5	10
a_2	1	6	12
a_3	5	6	6
a_4	10	7	3

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8.2 Consider the classical Economic Order Quantity model (EOQ). This model assumes an infinite production rate and the following parameters:

- b demand rate in units per unit of time
- f fixed order costs in monetary units per order
- c inventory carrying costs in monetary units per unit and unit of time

The variables are the order quantity q and the cycle time τ . (15 points in total)

8.2.1 What is the relation between the two variables q and τ ? (Hint: Highlight the relationship between both in mathematical notation) (1 point)

8.2.2 State and minimize the general cost function $K(\tau)$ in terms of the cycle time and derive the general formula for the optimal cycle time step by step. (3 points)

8.2.3 Consider the following parameter values:

- Demand rate: **$b = 300$ units** per day
- Fixed order costs: **$f = 750$ EUR** (per order)
- Inventory carrying costs: **$c = 1,25$ EUR** per unit and day

Calculate the optimal cycle time and order quantity for the given parameter values. (2 points)

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8.2.4 Consider the following parameter values:

Demand rate: **b = 100 units** per day

Fixed order costs: **f = 400 EUR** (per order)

Inventory carrying costs: **c = 2 EUR** per unit and day

Optimal order quantity: **q = 200 units**

Draw the inventory time plot for 9 days and mark the cycle time τ . (4 points)

8.2.5 In contrast to exercises 8.2.1-8.2.4, the classical Economic Production Quantity model (EPQ-model) is considered in the following. Therefore, we assume an open shop and a finite production rate p (with $p > b$).

Consider the following parameter values:

Demand rate: **b = 75 units** per week

Optimal cycle time: **$\tau = 4$ weeks**

Production time for the optimal production quantity: **$t^p = 3$ weeks**

Draw the inventory time plot for 12 weeks and mark the optimal production quantity. (5 points)

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8.3 The below table shows the demand for material A for the past 8 periods. (7.5 points)

P8	P7	P6	P5	P4	P3	P2	P1
900	1.030	1.070	1.000	1.050	925	1.075	950

8.3.1 State the general formulas for the following methods for calculating the averages in exercises a) and b). Label the used variables and calculate the estimated demand based on the given demands from the table.

- a) Moving average over six periods (**P3-P8**). (1 point)
- b) Weighted moving average over six periods, where **P3** is weighted with **1**, **P4** is weighted with **2**, **P5** is weighted with **3** and so on. (1.5 points)

8.3.2 In the following, the following forecasting procedures are given:

- Linear regression
- Weighted moving average
- Holt's method (double exponential smoothing)
- Holt-Winter's method (triple exponential smoothing)
- (Simple) Moving average

Briefly explain for which demand pattern the different procedures can be used. (5 points)

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9 Exercise 9 (10 Points, only for EIM applicants)

9.1 The core of a new business model is the business idea. **Name 5 questions an entrepreneur should answer when evaluating the potential of a new idea. (5 points)**

9.2 Describe Porter's two generic strategies Differentiation and Cost Leadership and discuss for which of these two strategies innovations are better suited. Give an exemplary innovation for each strategy. (5 points)
