

Chapter 1

Question 1 (15 credits)

R. Peters, Inc. is a leading supplier of maintenance, repair, and operating motors to businesses and institutions all over the world. Peters works with many suppliers in the Asia region. These suppliers produce motors to Peters' specifications and ship to the United States using ocean freight carriers from five major ports in Asia. The contracts that Peters has with Asian suppliers currently specify that the supplier owns the motors and is responsible for all costs incurred until the motors are delivered to the shipping port. Peters works with a freight forwarding company that coordinates all shipments from Asian suppliers.

Currently, suppliers first ship motors on pallets to consolidation centers operated by the freight forwarding company at the port locations. At the consolidation centers, motors are packed in 30 foot containers. From any port location in Asia, containers are shipped to the U.S. entry port in Los Angeles. After passing through customs, the containers are shipped by rail to Peters' central distribution center in Bakersfield. The containers are unloaded and quality is checked in Bakersfield. From there, individual items are sent to regional warehouses in seven U.S. locations.

- a. Draw a figure to describe the supply chain of R. Peters Inc. Indicate clearly all flows of product and all flows of information. (9 credits)
- b. Formulate two logistics decision problems that might occur in this supply chain of R. Peters Inc. (3 credits)
- c. Formulate four different types of logistics costs for R. Peters Inc. (3 credits)

Question 2 (3 credits)

The 'Triple Bottom Line' consists out of three core elements. Mention and shortly discuss these three elements. (3 credits)

Chapter 2

Chapter 3

Chapter 4

Question 1 (5 credits)

Chips and Chips Inc. supplies parts for a computer manufacturer, the demand for parts from the computer company is 15 units per hour. Each part has to go through a system with three main stages (Milling, Lathing, Assembly) in order to be completed. At the Milling stage, there are two identical machines operating in parallel. The production time of each machine follows a normal distribution with a mean of 6 minutes and a standard deviation of 5 minutes. At the Lathing stage, 16 products are processed in a batch at a single machine. The set-up time is 15 minutes per batch. Each product takes 3 minutes. At the Assembly stage, there is an assembly line with the capacity of 30 jobs per hour.

What is the productive utilisation at the Assembly stage? (5 credits)

Question 2 (3 credits)

Fly Inc. is a producer of recreational and military parachutes. Fly Inc. sells to customers worldwide, but its main customer base is in Europe and the US. Fly Inc. distinguishes two main product groups RecreParachute and ProParachute. RecreParachute is the brand available to consumers and ProParachute is available to institutional customers such as the army and the navy.

RecreParachute parachutes come in 3 different shapes, 2 different wingspans and twelve colors. Fly Inc. sells their parachutes only to certified retailers, which in turn sell the parachute to the consumer. ProParachute parachutes are always designed together with the institutional customer as the army might require a different parachute for different missions. The demand for RecreParachute parachutes shows a strong seasonal pattern, with demand peaking in the beginning of April. As parachuting in the Northern hemisphere is restricted from April until September due to the weather. Fly Inc. prides itself for being never out of stock, which is greatly valued by its customers. The demand for ProParachute parachutes is less predictable.

As RecreParachute parachutes are not subject to any fashion and the seasonal pattern is predictable Fly Inc. knows the amount of each parachute it should have on stock during the year without running out of stock. When the stock of a type of RecreParachute parachute comes below a certain level a production order is given for this specific type. The process for ProParachute parachutes is less simple and involves intensive communication between Fly Inc. and a customer. Once the design and technical aspects of the ProParachute parachute are agreed upon the purchasing department buys all the required materials needed for this product line.

The production process starts with getting the right fabric from the warehouse. A worker places the fabric on a light table which allows him to spot any flaws in the woven pattern. The next step is to feed the fabric to a laser cutter which cuts out the different pieces for a parachute. Depending on the model this can vary between 30 and 100. Now the parts are sewed together by hand using nylon tape to reinforce the seams. The different parts have holes that allow the flow of air between the layers to stabilize the descent. The parachutes are stored in a warehouse and have to wait on average 2 weeks before being transported to yet another quality control center where the stitches are checked for flaws. Every 2.5 cm of stitching needs to have between 7 and 10 stitches or else it could break during flight. The corners of the parachute are now reinforced with triangular patches made from woven nylon and steel wire. These patches will serve as the contact points for the 60 lines that connect the parachute to the jumper's harness. Now the lines can be attached by using a knot that can only be applied manually. This process takes 2 hours per parachute. The strings are attached to the harness and the parachute folded in a backpack. Each backpack is put into a wooden crate and transported to the warehouse. Depending on the type of product it will be sent to the RecreParachute warehouse or the ProParachute storage facility.

The same consultant advises Fly Inc. to start processing the orders for RecreParachute parachutes in the same way as ProParachutes. This, he argues will allow Fly Inc. to benefit from economies of scale. Discuss whether the consultant provides Fly Inc. with good or bad advice. (3 credits)

Chapter 5

Chapter 6

Question (12 credits)

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- a. In the case above one or several Customer Order Decoupling Point(s) can be distinguished. Explain for each CODP how you characterize it (e.g. MTO, MTS) and where it is positioned in the process. (4 credits)
- b. For each CODP discuss two forces which caused the current position of the CODP. (4 credits)
- c. An external consultant advised Fly Inc. to adopt a 'Fixed Position lay-out'. The production manager of Fly Inc. disagrees with the consultant and argues that there is nothing wrong with the current lay-out. Explain which lay-out type Fly Inc. has and discuss whether the advice of the consultant should be followed or not. (4 credits)

Chapter 7

Question 1 (5 credits)

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Suppose that the demand is increased to 18 units per hour. What is the minimum batch size at the Lathing stage in order to fulfill the demand requirement? (5 credits)

Question 2 (15 credits)

Martin opens a drive-thru with one cashier. Customers will enter the "place order" line to meet the cashier. Currently, it takes the cashier on average 4 minutes to complete an order, following a negative exponential distribution. During an hour, 12 customers arrive on average (the number of arrivals is Poisson distributed).

- a. What is the probability that at most 3 customers are waiting? (5 credits)
- b. What is the average number of customers in the drive-thru area? (5 credits)
- c. The manager estimates that every minute a customer spends waiting in line, it costs \$1 due to customers' dissatisfaction, and loss of future business. To improve the service, the manager sends the cashier to a strict training class. After the class, the cashier can take an order in exactly 3 minutes. What is the expected cost saving per hour caused by the training? (5 credits)

Chapter 8

Chapter 9

Chapter 10

Question 1 (5 credits)

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Quality is very important for Fly Inc.; in the chapter 'Quality management and six sigma' six dimensions of quality are mentioned e.g. (1) performance and (2) perceived quality. Mention the other four dimensions of quality and discuss which two dimensions are the most important for Fly Inc. (5 credits)

Question 2 (11 credits)

Jamma is a manufacturer of chairs and desks. In comparison to their competition Jamma is seen as a discounter. Their goal is to be the cheapest producer in every product range.

The operations strategy of Jamma is “to provide standard basic furniture at the lowest possible costs”. The table below shows the costs of quality (conform the “quality is free” concept by Crosby) of Jamma over the year 2013.

Cost element	Cost (Euro)
Warranty payments	65000
2 full-time quality inspectors	110000
Scrap and rework	70000
Quality-audit by external consultants	35000
Complaints management 1 full-time employee	45000
Annual “quality-day” for all the factory workers	10000

- a. Four types of cost of quality are distinguished in the Chapter “Quality Management and Six Sigma”. Mention these four types of costs and explain which cost element in the table above relate to these types. (4 credits)

Consider yourself as the Supply Chain Manager of Jamma. Your HR colleague introduced the plan to give all supply chain employees within Jamma a quality improvement training. The costs of this training are attributed to you “cost of quality” budget and amount up to approximately Euro 400000.

- b. Do you agree with the plan of your HR colleague? Why (not)? (3 credits)

PAINTPINK is a company that delivers pigments for the plastics industry. The color of the pigments provided by PAINTPINK is often measured with a light spectograph.

The color yellow is represented by a value of 580 nanometer (nm). The operations manager of PAINTPINK received an order which specifies that the spectograph value should be between a value of 575nm and 585nm.

By means of sampling the production process it is determined that the x-bar chart in SPC (Statistical Process Control) on the central line (CL) have a spectograph value of 576nm with an upper and lower control limits (UCL and LCL) which can have a spectograph value of 2nm higher or lower than the CL.

- c. Determine the Process Capability Index for this pigment (show your calculation) and use this index to determine what the operations manager should do in short and in long term. (4 credits)

Chapter 11

Question (5 credits)

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What is the corresponding Work-in-Progress in the system? (5 credits)

Chapter 12

Question (4 credits)

An important research question in the lean-philosophy is whether the lessons learned in the automotive industry can also be applied in other sectors. Recently many hospitals start to apply the lean philosophy.

Discuss five tools of lean which are suitable for a hospital. Further discuss one aspect of lean which is hard or impossible to implement. (4 credits)

Chapter 13

Question (7 credits)

- Mention and discuss three causes of the 'Bullwhip effect'. (6 credits)
- According to Jacobs and Chase types of sourcing can differ greatly. The book mentions several of these types one of which is 'Vendor Managed Inventory' (VMI). Explain the concept of VMI. (1 credit)

Chapter 14

Question (10 credits)

The logistics manager of Rainbow Beers has decided to determine in a mathematical way the location of their distribution centre in the Netherlands. From this distribution centre, trucks transport beers with a certain delivery frequency to the stores in Amsterdam, Utrecht, Enschede and Groningen to fulfil the demand of the customers of these stores. Information on the delivery frequency per store and the x- and y-coordinates of each city are given in the table below.

City	Delivery frequency	X-coordinate	Y-coordinate
Amsterdam	1 truck each working day	-10	-10
Utrecht	1 truck per week	30	20
Enschede	4 trucks per week	5	-20
Groningen	1 truck each 2 weeks	25	45

- With the same delivery frequency for all the cities, what is the minimal number of trucks for Utrecht in order to make the x-coordinate no less than 5.8? (5 credits)

- b. Determine the optimal (x,y) -coordinates for the location of the distribution centre. (5 credits)