5 Guiding Solutions

5.1 Guiding solutions for chapter 1

Case assignment 1.1

The three other relevant cost areas could for instance be:

- Accounting/Control
- Management "by one"
- Indirect costs

Case assignment 1.2

The activities can be listed according to cost types as follows:

- *The work time the French fashion designer and the management have already used on the perfume project*. This is a sunk cost as it has already been defrayed and can not be recovered; therefore the cost is not relevant for decision making.
- *The development of the design of the perfume bottle, to be developed by Innocence's own designers.* This is an irreversible cost as the costs of development can not be recovered even if the production is stopped. Moreover, the cost is dependent on the further progression of the project which makes it decision relevant. If no new people are hired the costs (the draw on resources of the existing designers) are hard to assess.
- *The hiring of a head of marketing in Innocence. The head of marketing is to be responsible for promoting the perfumes, including segmentation of markets, choice of marketing strategy etc.* This is a reversible cost, as the head of marketing can be laid off and the costs thereby terminated. As the costs depend on the further progression of the project, this cost is decision relevant. Moreover, this cost is fixed in the short-term and variable in the long-term, as the head of marketing supposedly only can be laid off in the long-term.
- *The marketing campaign for the perfumes. This is accomplished with cooperation from Innocence's marketing department and an external marketing agency.* This is an irreversible cost, as the costs of the marketing campaign cannot be recovered even if the production is stopped. The cost is dependent on the further progression of the project and thus decision relevant. In this case it is an interesting factor whether or not he campaign can be stopped.

- *The Italian perfume manufacturer's future work with the production of the perfumes i.e. costs of the outsourcing.* This cost is reversible as it is terminated if the production is stopped. The cost is dependent on the further progression of the project and is thus decision relevant. The cost is fixed in the short term as Innocence presumably is tied to a contract, which is only able to be cancelled in the long-term, where the cost becomes variable.
- *The administrative work concerning the project, including cooperation with the Italian perfume manufacturer.* This cost is reversible as it is terminated if production is stopped. The cost is dependent on the further progression of the project and is thus relevant for decision-making. The cost is fixed in the short term as the administrative work concerning the outsourcing does not presumably end before outsourcing is terminated. Based on the same argumentation, the cost is variable in the long-term where it is possible to cancel the contract.

Case assignment 1.3

The difference is that the two irreversible costs (development of the perfume bottles and the marketing campaign) have been defrayed. This means that they should be categorized as sunk costs, and are therefore no longer relevant for decision-making.

Question 1.1

1. It is presumably possible to support the statement of the professor by using numerous textbooks on business economic theory, but this does not mean that he is right – at any rate not in relation to the real world. This owes to the fact that sneaking costs are easily missed, if the fixed costs are not analyzed in connection to short-term cost considerations. Sneaking costs typically emerge together with additional administrative burdens (typically in administration and management).
2. Moreover the professor's statement will possibly have a problem concerning the division of fixed and variable costs. This division depends on the time horizon and thereby on the decision-making situation. If both the variable and fixed costs are not analyzed, this division will probably not be of any use.
3. The costs for the sales force is fixed in some situations and variable in others.

Question 1.2

A possible explanation could be that the foreman and/or the production workers have experience with the working process. This experience can have resulted in an increased efficiency, which in connection with a proper management effort, has reduced the average costs. This possibility can be attributed to *the learning curve.* Furthermore a simple answer could be that production has increased and that the reduction in costs per unit has been greater than the increase in variable costs. Besides, the fixed costs may have been reduced.

Question 1.3

1. When a business has to establish sales prices, the costs of production are one decisive factor, owing to that the costs should be included in the price/quantity optimization. Moreover the long-term raîson d'etre (reason for being) for the business depends on its ability to, at a minimum, cover the costs.
2. Regarding the decision of whether to produce or outsource the costs, both are decisive. This is due to the company needing to consider outsourcing only if the costs of outsourcing are lower than the costs of own production. Beside the costs, this decision-making situation should also include supplier dependence, confidence of delivery, quality, etc.
3. Likewise, decisions concerning the firm's production level also demand a thorough knowledge of the costs, owing to the production level having great influence on the costs. Therefore the production level has to be established considering the costs.

Question 1.4 **Scenario 1. He sells the farm, takes the part time job and finds another place to live:**

1. He sells the buildings and the machines, resulting in a payment before tax of DKK 12 million + DKK 2 million = DKK 14 mill.
2. Tax has to be paid of DKK 0.5 mill. + DKK 3 mill. = DKK 3.5 mill (in relation to selling the land, the buildings, and the machines)
3. He now has DKK 14 mill. – DKK 3.5 mill. = 10.5 mill.
4. The loan of 6 mill. is repaid: DKK 10.5 mill. – DKK 6 mill. = DKK 4.5 mill.
5. DKK 4.5 mill is invested at an annual rate of 6%, which before taxes is DKK 4.5 mill. × 0.06 = DKK 0.27 mill. After taxes this is DKK 270,000 × 0.5 = DKK 135,000.
6. He accepts the part time job at DKK 150,000 a year. After taxes this equals an annual income of DKK 150,000 × 0.5 = DKK 75,000.
7. He finds another place to live, costing DKK 50,000 a year.
8. At his disposal after taxes Scenario 1 results in a total of DKK 135,000 + DKK 75,000 – DKK 50,000 = DKK 160,000.

Scenario 2: He rents out the land, takes the part time job and stays at the farm:

1. The land is rented out which before taxes yields DKK 5,000 × 100 hectares = DKK 500,000 a year. After taxes this equals an annual income of 500,000 × 0.5 = DKK 250,000.
2. The machines are sold, yielding DKK 2 mill. before taxes. In connection to the selling of the machines a tax of DKK 0.5 mill. is paid. After taxes 1.5 mill. remains.
3. The loan is reduced by DKK 1.5 mill. resulting in a loan of DKK 4.5 mill.
4. Interests of the loan equal DKK 4.5 mill. × 0.05 = 225,000 a year. After taxes this is an annual expense of DKK 225,000 × 0.5 = DKK 112,500.
5. He rents out the buildings which before taxes equals an annual income of DKK 50,000. After taxes this is DKK 50,000 × 0.5 = DKK 25,000.
6. He accepts the part time job yielding DKK 150,000 a year. After taxes this is DKK 150,000 × 0.5 = DKK 75,000.
7. At his disposal after taxes Scenario 2 yields a total of DKK 250,000 – DKK 112,500 + DKK 25,000 + DKK 75,000 = DKK 237,500.

Scenario 3: He continues the operation of the farm, declines the part time job offer and stays at the farm:

1. He achieves an estimated profit after corporation taxes and interests of DKK 400,000 a year. After income taxes the yield is DKK 400,000 × 0.5 = DKK 200,000.
2. He rents out the outhouse which before taxes yields DKK 50,000. After taxes this is DKK 50,000 × 0.5 = DKK 25,000.
3. At his disposal after taxes Scenario 3 yields a total of DKK 200,000 + DKK 25,000 = DKK 225,000

The farmer should choose scenario 2, as this gives him the greatest annual amount at his disposal after taxes.

Other financial considerations that should be included (not exhaustive):

- Risks concerning operations of the farm, including the future prospects of agriculture in Denmark (e.g. developments in prices of purchase and sales, wage level for employees, etc.)
- Full or partial termination of EU agricultural subsidies
- Future circumstances concerning interests and taxes.
- Future prospects for the part time job, including wage conditions, and retirement age.

Question 1.5 **Arguments for a reduction in consumer prices:**

When a number of companies are merged, double positions are typically eliminated, i.e. employees that before the merger held the same position are re-shuffled or laid off.

Moreover economies of scale are often achieved, leading to lower costs. The economies of scale could be a result of the following (not exhaustive):

- Cheaper access to raw materials, distribution, etc.
- Increasing production specialization, including simplification of work processes.
- Greater corporations => greater production => greater effect of the learning curve.

Arguments for lower consumer prices:

When a number of companies are merged, typically, the market competition is reduced. This can result in companies not constantly being pushed to minimize costs, as they are no longer in the same tough competitive environment.

Less competition => stronger suppliers => increased price supplements. One example of this is the debate about the pricing in Arla Foods after the merger of Arla and MD Foods in September 1999.

Moreover diseconomies of scale can emerge, resulting in increased costs. The diseconomies of scale could be a result of (not exhaustive):

- Major corporations typically have more management levels than minor companies in the same industry, as the communication tasks escalate as the business grows. More management levels can cause that the percentage of the workforce that is directly productive to decrease.
- Risks that the communication tasks and division of labor in practice do not work as well after the merger. This could be a result of the corporation becoming to large and bureaucratic. However, it could also be a consequence of well-run sections being split up, or of incompatible business cultures, etc.

5.2 Guiding solutions for chapter 2

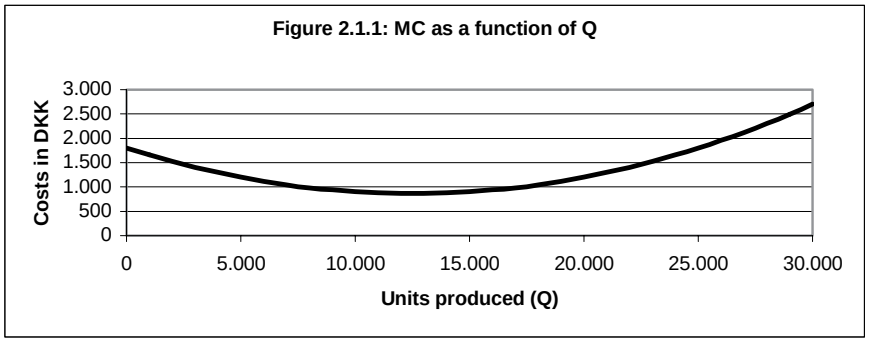
Case assignment 2.1

$TC = 0.000002Q^3 - 0.075Q^2 + 1.800Q + 5{,}000{,}000$

In order to find the MC function, the TC function is differentiated regarding Q:

$MC = TC' = 0.000006Q^2 - 0.15Q + 1{,}800$

The MC function can be illustrated as shown in figure 2.1.1:



Case assignment 2.2

The explanation for the progression of the MC function could be that Guns and Thrills achieve economies of scale at a low production level, e.g. because of increasing purchasing discounts, which explains why the MC function is declining until about 12,500 units. The company, can at the same time, have diseconomies of scale at a high production level, caused of increased waste, less efficient employees etc. explaining why the MC function incline after about 12,500 units.

Case assignment 2.3

$TC = 0.000002Q^3 - 0.075Q^2 + 1{,}800Q + 5{,}000{,}000$

First the TVC function is found by subtracting the fixed costs (5,000,000) from the TC function:

$TVC = 0.000002Q^3 - 0.075Q^2 + 1{,}800Q$

In order to find the AVC function, the TVC function is divided with Q:

$$AVC = \frac{TVC}{Q} = 0.000002Q^2 - 0.075Q + 1{,}800$$

Case assignment 2.4

The minimum point for the AVC function can be deduced in the following two ways:

1. The AVC function is differentiated and put equal to 0:

$AVC' = 0.000004Q - 0.075$
$0.000004Q - 0.075 = 0$
$0.000004Q = 0.075$ (here 0.075 is added on both sides)

$Q = \frac{0,075}{0,000004} = 18,750$ (here a division of 0.000004 is carried out on both sides)

i.e. the minimum point of the AVC function is reached at a production of 18,750 units.

2. The AVC function is put equal to the MC function:

$AVC = MC$
$0.000002Q^2 - 0.075Q + 1,800 =$
$0.000006Q^2 - 0.15Q + 1,800$
$0.000002Q^2 - 0.075Q =$
$0.000006Q^2 - 0.15Q$ (here 1,800 is subtracted from both sides)

$-0.075Q = 0.000004Q^2 - 0.15Q$ (here $0.000002Q^2$ is subtracted from both sides)

$0.000004Q^2 = 0.075Q$ (here 0.15Q is added to both sides – and sides are swapped)

$0.000004Q = 0.075$ (here a division with Q is carried out on both sides)

$Q = \frac{0,075}{0,000004} = 18,750$ (here a division of 0.000004 is carried out on both sides)

i.e. the minimum point of the AVC function is reached at a production of 18,750 units.

Case assignment 2.5

Other American manufacturers of the same type of assault rifles will probably have different cost functions because they have:

- Another production design
- Another combination of production factors
- Another kind of technology
- Another group of employees
- Another kind of outsourcing
- Another internationalization
- Another management and management philosophy

The explanation is that the above factors affect the costs and thereby the cost functions.

Case assignment 2.6

The way in which the company estimated its TC function could be connected to a large number of possible sources of error, including:

- The different cost levels the estimate is based on, are defined at different times in history. Therefore the different cost levels could be affected by the other factors than production size, e.g. purchasing prices, wage level, coincidence, etc.
- The estimate is furthermore based on a other-things-equal philosophy (ceteris paribus) presuming that all relevant factors, including prices, wage level, production design, combination of production factors, technology, employees, outsourcing, and internationalization do not change in the future. However this is not the case, and it can be quite difficult to establish an overview of the cost-related consequences of changes in these factors.
- As seen in figure 2.1 the estimate is based on observations at production sizes of between 6,000 and 26,000 units. Consequently it is not absolutely certain that the TC function can be applied at production sizes outside this production interval.
- The TC function could be influenced by the other products produced by the company at the different times in history. The product combination could be different now as well as in the future.

Case assignment 2.7

The progression of the TC function is determined by, among others, the following factors:

- purchasing prices
- Economies/diseconomies of scale
- The learning curve
- Hourly rate in production, including overtime bonuses

Question 2.1

$MC = 0{,}003Q^2 - 0{,}8Q + 120$

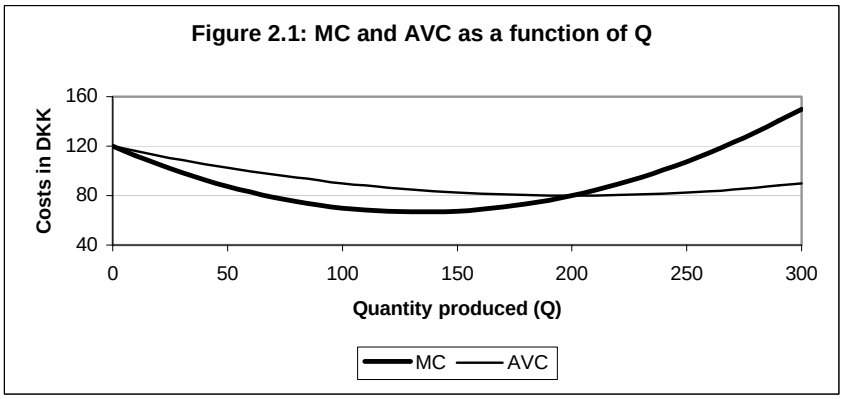
In order to find the AVC function, the TVC function has to be deduced. The TVC function is found by integrating the MC function regarding Q:

$$TVC = \int MC = 0{,}001Q^3 - 0{,}4Q^2 + 120Q$$

In order to find the AVC function, the TVC function is divided with Q:

$$AVC = \frac{TVC}{Q} = 0{,}001Q^2 - 0{,}4Q + 120$$

The coherence between the MC gunction and the AVC function is illustrated in figure 2.1:



As seen in figure 2.1 the AVC function is declining when the MC function is below the AVC function, while the AVC function inclines when the MC function is above the AVC function. The consequence of this connection is that the AVC has its minimum at the point where the MC crosses the AVC from below. (A further explanation of this connection is found in the guiding solution to question 2.5.

Question 2.2

Q	0	1	2	3	4
MC	-	100.000	90.000	98.000	104.000
TVC	0	100.000	190.000	288.000	392.000
TC	1.000.000	1.100.000	1.190.000	1.288.000	1.392.000
AVC	-	100.000	95.000	96.000	98.000

Question 2.3

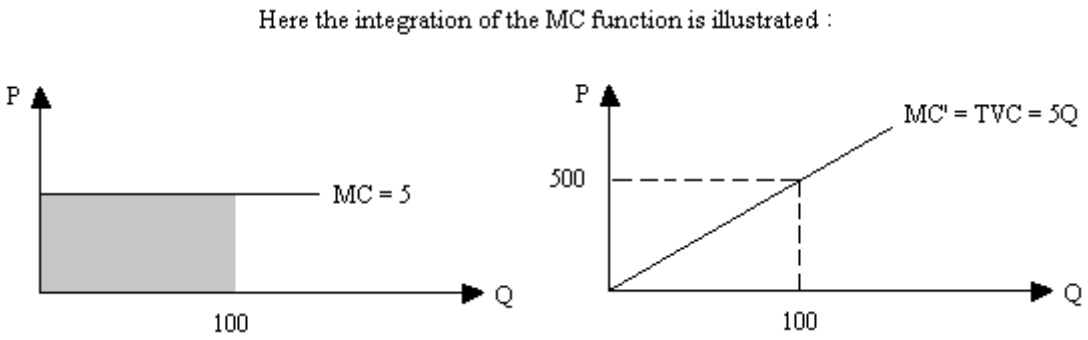
When a mathematical function is integrated, then the area below the function is deduced. The area below the MC function comprises the total variable costs, i.e. the costs of producing unit no.1, unit no. 2, unit no.3…= $\sum_{1}^{n} MC$. Therefore the TVC function is found through integration of the MC function. This is explained by means of the following example:

A company has marginal costs of DKK 5 per unit, why the MC function logically is: MC =5

By producing 100 units the total variable costs DKK 500, which is found by applying basic reasoning, i.e. 100 units at DKK 5 each. The total variable costs could alternately be found by integrating the MC function – and afterwards put 100 into the TVC function. This is shown below:

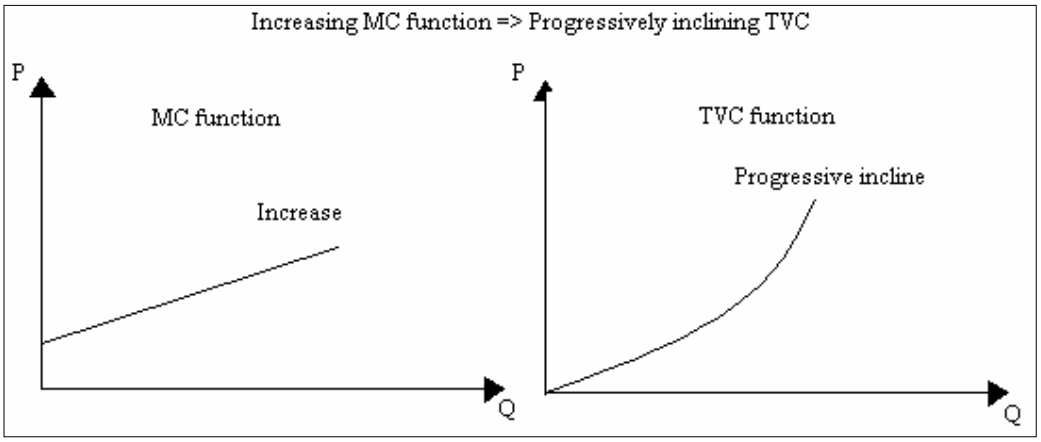
Here the MC function is integrated: MC = 5 => MC' = TVC = 5Q
Here 100 is put into the TVC function: TVC = 5 x 100 = 500

As seen this method yields the same result as the basis reasoning, i.e. total variable costs of DKK 500. The integration process is illustrated below:



Question 2.4 When the company has an increasing MC function, the TVC function increases progressively.

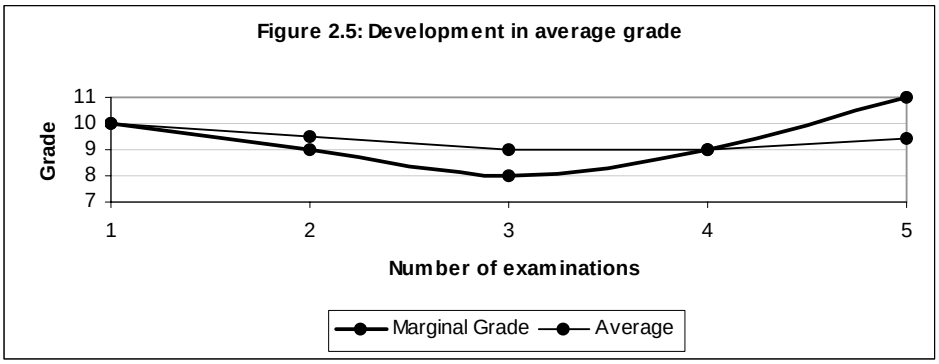
The explanation is that an increasing MC function means that the most recently produced unit consequently causes a greater increase in total variable costs than the unit just before. As a result, the TVC increases more and more as a function of Q. This is illustrated below:



Question 2.5

When the MC-function is below the AVC function, the AVC function is constantly pulled downward as the marginal costs are lower than the average variable costs. When the MC function crosses the AVC function from below, the marginal costs are getting higher than the average variable costs, why the AVC function is pulled upward. The AVC has its minimum in the point where the MC function crosses the AVC function from below as the MC function from this point changes from pulling the AVC function downward to pulling the AVC function upward.

This can be exemplified by using grades/marks. Imagine you get a 10, which is equal to your marginal grade is 10. This gives an average of 10. Your next grade is 9, resulting in your average being 9.5, i.e. your marginal grade has pulled your average downward. Your next grade is 8, resulting in an average of 9. Your marginal grade has once again pulled your average downward. Your next grade is 9, after which your average is still 9. Your marginal grade has not changed your average. Your next grade is 11, after which your average is 9,4. Your marginal grade has pulled your average upward. This is illustrated in figure 2.5:



Question 2.6 The ATC function has its minimum at a larger production than the AVC function has because the ATC function contains fixed costs. The ATC function is on a higher level than the AVC at all sizes of production. This means that the MC function crosses the ATC function at a greater production than when it crosses the AVC function. It should be mentioned that both the AVC and the ATC functions are in their minimum at the point where MC crosses them from below.

Question 2.7 The marginal costs are influences in the following way:

An increase in the hourly wage for of the production workers => MC increases. This owes to the increasing production costs, and thereby the increase in the costs of producing one more unit.

An accumulated quantity discount => MC decreases. At the exact quantity that sets off the discount the MC will decrease noticeably, as the discount is retroactive. Thereafter the MC will be lower if the discount applies to the next purchased quantity.

Increasing taxes on real estate => MC is not affected. This owes to increasing real estate taxes causes increased fixed costs, which do not influence the costs of producing one unit.

Increasing costs of administration => MC is not affected. This owes to increasing administrational costs causing increasing fixed costs, which do not influence the costs of producing one unit.

Question 2.8 The time horizon "short-term" cannot be defined definitely when working out the cost functions. This is due to the cost functions being dependent on both business sector and company, e.g. the time horizon short-term will probably be shorter in an architect firm than in a brewery. Moreover the time horizon short-term can be further divided into extremely-short-term and medium-short-term. However it should be mentioned that the classic definition of the short-term is that at least one of the factors of production within the time horizon cannot be adapted, i.e. it is considered a fixed cost.

Examples of short-term: Street seller = 1 day; Harboe = 3–4 weeks; haulage contractor = 3 months

Question 2.9 The MC function is deduced from the ATC function in the following way: The ATC function is multiplied with Q => the TC function. The TC function is differentiated regarding Q = The MC function. It is however impossible to deduce the ATC function from the MC function, as this does not include the fixed costs (FC). The point is that it is irrelevant whether the TC function or the TVC function is differentiated, as the constant of the TC function (the fixed costs) disappear when differentiated. When the MC function is integrated it is only possible to find the TVC function. On basis of this the AVC function can be deduced but not the ATC function.

5.4 Guiding solutions for chapter 4

Case assignment 4.1 **The contribution margin model for a single bicycle mending operation:**

Direct variable costs:

- The apprentice's wage per mending = DKK 75 per hour / 6 mending repairss per hour = **DKK 12.5**
  The mechanic's wage per mending = DKK 140 per hour / 10 mends per hour = **DKK 14**
- It is not known who receives the customer and thereby uses 6 minutes per mending. Therefore it is assumed that they take turns at this too. Assuming this the average wage for reception etc. => (DKK 75 per hour + DKK 140 per hour) / 2 = DKK 107.5 per hour = 107.50. As it takes 6 minutes per reception the costs of wage per reception etc. = DKK 107.50 per hour / 10 receptions per hour = **DKK 10.75.**
- Costs of patch, glue, power, etc. per mending is = **DKK 2**
- The direct variable costs per mending, if the mending is carried out by the apprentice = DKK 12.50 + DKK 10.75 + DKK 2 = ***DKK 25.25***
- The direct variable costs per mending, if the mending is carried out by the mechanic = DKK 14 + DKK 10.75 + DKK 2 = ***DKK 26.75***

The indirect variable costs:

- In connection to each mending operation, the tools are worn to some degree. This wear and tear cannot be attributed to the single task in the workshop, why a distribution key must be applied. The distribution key in this case is the share in turnover. As 15% of the turnover are created by mending operations, 15% of the workshop maintenance is attributed to the mending as well. In this way DKK 30,000 × 0.15 = DKK 4.500 is attributed to the mends. Subsequently these costs are divided on to the number of mending operations carried out the year before. This yields an indirect variable cost of = DKK 4,500 / 6,000 mends = **DKK 0.75**
- Indirect variable costs per mend = ***DKK 0.75***

Costs for a single mending using the contribution margin model are, if carried out by the apprentice = DKK 25.25 + DKK 0.75 = ***DKK 26***

Costs for a single mending using the contribution margin model are, if carried out by the mechanic = DKK 26.75 + DKK 0.75 = ***DKK 27.50***

The full cost model for a single bicycle mending operation:

As estimated by using the contribution margin model, the total variable costs per mending, if carried out by the apprentice = DKK 26, and 27.50 if carried out by the experienced bicycle mechanic.

The direct fixed costs:

- The rent for the workshop, which is a relevant part of the building, is distributed using the turnover as distribution key. In this way DKK 20,000 x 0.15 = DKK 3,000 are attributed to the mending operations per year. Subsequently this cost is divided on to the number of mending operations carried out last year. These yields a fixed cost per mending operation of DKK 3,000 / 6,000 mending operations = **DKK 0.50**
- The direct fixed costs per mending operation = ***DKK 0.50***

Indirect fixed costs:

- The rent for the sales and show room, which is a non-attributable location, can be distributed by using the share of turnover of 15%. This yields a total cost of DKK 40,000 × 0.15 = DKK 6,000 a year. This cost is distributed on the number of mends last year, yielding an indirect fixed cost per mend of DKK 6,000 / 6,000 mends = **DKK 1**
- The bicycle shop and the assets could be sold which would release capital worth DKK 2 mill. + DKK 1 mill. = DKK 3 mill. The released capital could be invested at 5% a year, which results in an opportunity cost of operating the shop of DKK 3 mill. × 0.05 = DKK 150,000 a year. This opportunity cost is distributed on to the mends using the share of turnover of 15% as distribution key. This results in a total cost of DKK 150,000 × 0.15 = DKK 22,500 for mends per year. These costs are distributed to the number of mends last year, which yields an indirect fixed cost per mend of DKK 22,500 / 6,000 mends = **DKK 3.75**
- The owner could earn DKK 200,000 annually by accepting another job, which likewise represents an opportunity cost. This opportunity cost can be distributed by using the share of turnover of 15% as a distribution key. This yields a total opportunity cost of 200,000 × 0.15 = DKK 30,000 for mends per year. This cost is subsequently divided on to the number of mends per year, yielding an indirect fixed cost per mend of DKK 30,000 / 6,000 mends = **DKK 5**
- Indirect fixed costs per mend = DKK 1 + DKK 3.75 + DKK 5 = ***DKK 9.75***

By using the full cost model, the costs of a single bicycle mending operation is, if carried out by the apprentice = DKK 26 + DKK 9.75 = ***DKK 35.75***

By using the full cost model, the costs of a single bicycle mending operation is, if carried out by the experienced mechanic = DKK 27.50 + DKK 9.75 = ***DKK 37.25***

Case assignment 4.2

If the owner wishes to continue the operation of the store, and thereby just wants to assess whether or not the price of mending is to be raised, the contribution cost model is the most suitable. This owes to the owner in this situation just considers one activity that has no effect on the fixed costs.

On the other hand, if the owner considers to sell the store, and thereby wishes to assess whether or not the mends are profitable from a comprehensive point of view, then the full cost model may be more suitable. This owes to the owner in this circumstance has to include the fixed costs, as these are to be defrayed if operations are to be continued.

Case assignment 4.3

Besides the costs/turnover of the mends, the following consditions should be considered:

- The cheap mends' derived effects. When the customer has first entered the store, the employees are often capable of convincing him of changing tires and inner tubes instead of having it mended. Moreover it is possible to sell other bicycle equipment, and once in a while maybe a brand new bicycle.
- The customer reactions on changes in price of mends, including price elasticity.
- What tasks the apprentice and the bicycle mechanic could carry out in liberated working time.

Question 4.1

Frequent decision situations for a pizzeria:

1. How much should a pizza slice cost? Here could one distinguish between next week's price and the minimum sales price. Under both circumstances the pizzeria should know the costs of producing one pizza slice. Concerning next week's price, the contribution margin model would be suitable. If it is about the minimum sales price, then the full cost model will be more appropriate, as all costs in the long term are to be covered by the turnover.
2. How much should a special version cost? In this case it is relevant to know the extra costs of putting extra stuffing on the pizza. As this does not affect the fixed costs, such as rent, depreciations, etc. it only affects the variable costs. Therefore the contribution margin model is suitable.

3. Should the pizzeria make the pizza dough itself, or should they outsource it to the local baker's? In this case the pizzeria should know all the costs connected to the production of pizza dough. In this case the ABC model should be applied as it focuses on the costs that would possibly be eliminated by outsourcing.
4. Should the pizzeria be open Thursday, Friday and Saturday night because of the active night life in the city? Here the pizzeria should know all the extra costs of this initiative. The fixed costs og rent, depreciations, etc. are defrayed under all circumstances. Therefore this change concerns the variable costs only, and as such the contribution margin model is most suitable. However is should be mentioned that the increased exploitation of capacity will pull the average costs downward from a full cost point of view, while the night bonus will pull the costs upward.

Question 4.2 Examples of distribution keys that could be relevant for Harboe in relation to calculations of production of Harboe pilsners:

- Size of the area of relevant building sections compared to the total production area.
- Turnover of Harboe Pilsner in relation to total turnover.
- Number of employees exclusively working with Harboe Pilsners, in relation to the total number of employees. Here you could distinguish between white-collar and blue-collar.
- Production of Harboe Pilsners measures in units compared to the total production.

Question 4.3 The time horizon is included in calculations relating to the division of costs into fixed and variable. In the short-term the company employs the existing facilities – and has thereby a number of fixed costs in relation to this. In the long-term the company can adjust the facilities in relation to the production and new technology, why more costs are considered variable.

Question 4.4 As the MC function expresses the costs of producing one unit more, only the variable costs should be included in this. Therefore the contribution margin model is typically the basis of the MC function. This owes to the ABC model and the full cost model both operate with distribution of fixed costs.

The MC functions are hard to define in reality because of the following points (not exhaustive):

- It is difficult to assess the draw on resources when producing a single unit more, e.g. which unit triggers the additional costs of wage bonuses and administration, etc.
- The costs of producing one unit more depends on a number of factors that are difficultly established in advance, e.g. the fluctuating worker efficiency during the day.
- It is difficult to establish mathematical functions in real businesses because of the lack of full information, and unambiguous connections between the quantity produced and the costs, the continuity of production, etc.