

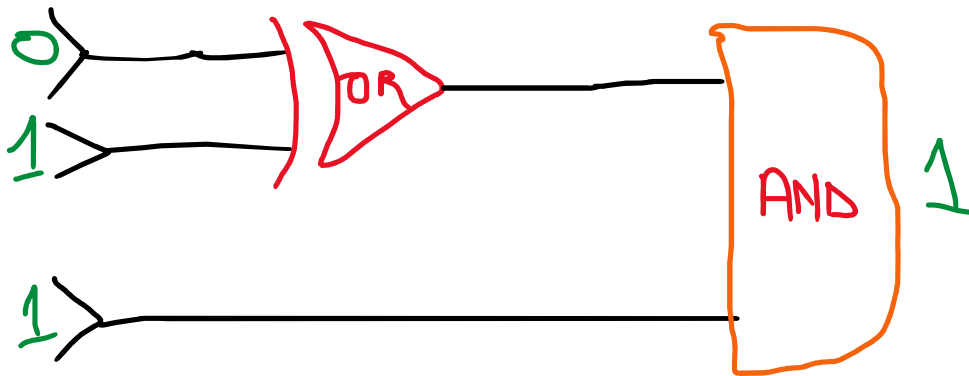
# Opgaver til Computersystemer

## Opgave 1.1 - Spørgsmål & Øvelser

1. What input bit patterns will cause the following circuit to produce an output of 1?

As seen on the picture below, it is clearly seen that the flowchart shows that the red one is (OR). So, when two of the inputs are 1, the output here becomes 1 in the end.

When you look at the orange one, then you can clearly see that 1 is inserted below and then  $1 * 1 = 1$  is resulted as output in the end.



2. In text, we claimed that placing a 1 on the lower input of the flip flop in Figure 1.3 (while holding the upper input at 0) will force the flip-flops output to be 0. Describe the sequence of events that occurs within the flip-flop in this case.

To explain it again, what happens is that the two rules of AND and OR are applied.

$$OR = F = X + Y = 1 + 0 = 1$$

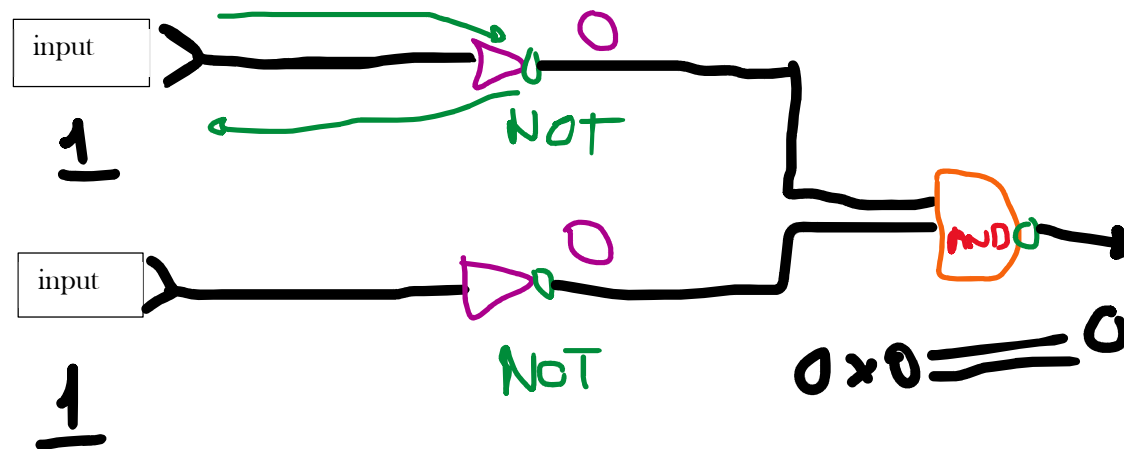
$$AND = F = X * Y = 1 * 1 = 1$$

The figure from 1.1.1 shows that when we put a 0 and 1, then it results a 1 in the end. When we on the other hand put 1 on the other place, then we can see that through multiplication we get 1.

3. Assuming that both inputs to the flip-flop in Figure 1.5 begin as 0, describe the sequence of events that occurs when the upper input is temporarily set to 1.

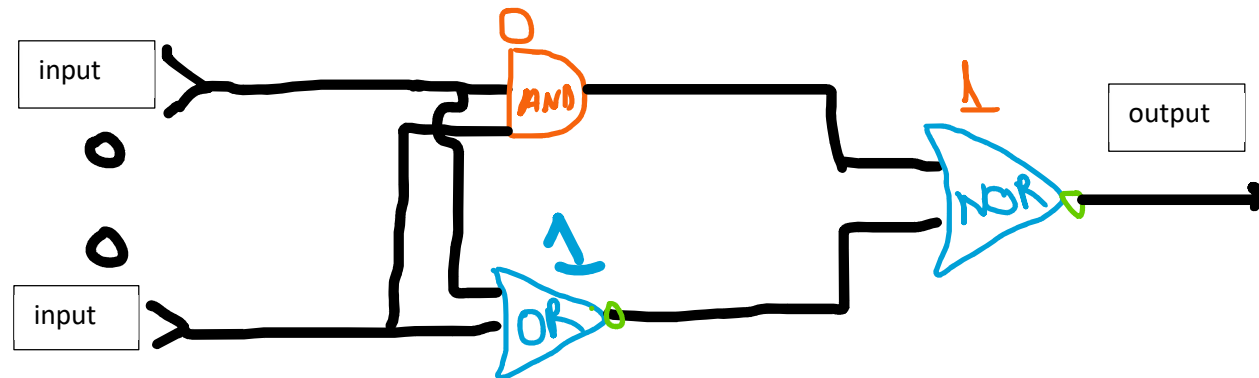
To repeat it again, when we put 1 then it is clearly converting into 1 - because of the OR-concept.

- 4.a. If the output of an AND gate is passed through a NOT gate, the combination computes the Boolean operation called NAND, which has the output of 0 only when both its inputs are 1. The symbol for a NAND gate is the same as an AND gate except that it has a circle at its output. The following is a circuit containing a NAND gate. What Boolean operation does the circuit compute?



Looked at the picture above, it is clearly seen that when we put 1 in the input then it gets redirected back to its starting point. The reason is clear and that is because we have a NOT-concept which is the green circle located after the pink triangle. Because we don't get any number, then we can see that we get 0. In this case, the 0-number goes forward towards the AND-concept and because the AND-concept is all about multiplying the two numbers then we get in the end 0.

4.b If the output of an OR gate is passed through a NOT gate, the combination computes the Boolean operation called NOR that has an output of 1 only when both its inputs are 0. The symbol for a NOR gate is the same as an OR gate except that it has a circle at its output. The following is a circuit containing an AND gate and two NOR gates. What Boolean operation does the circuit compute?



If you look closer towards the picture, you can see that the Boolean circuit begins with 0 in the upper part. Thereafter it goes through 0 and gets converted into 1. In this case we can see that the number goes towards the and again and gets converted into 0.

Whereas if we look at the other part, we can clearly see that because we don't have any 1. But if we look backwards from NOR and towards OR, then it is clearly seen that 1 is going towards OR and is becoming 0 and when that becomes 0 it goes forward and becomes 0 again in the AND-section.

5. Use hexadecimal notation to represent the following bit patterns:

a. 0110101011110010

- The way we want to use hexadecimal notation is to use the calculator and convert into binary, normal and different numbers. But in this case, we have decided to use the table, given by the teacher in course 2.

- 0x6AF2

b. 111010000101010100010111

- We will use the same method here in this case.

0xE85517

c. 01001000

- 0x48

6. What bit pattern are represented by the following hexadecimal patterns?

a. 0x5FD97

- The way we will solve this Question is to use the calculator and then we will be able to tell, what the hexadecimal patterns are in binary numbers.

- I have created a table, so we can clearly have an overview over the other things as well.

Numbers in Programming	Answers
Hexadecimal patterns = We write in the calculator	0x5FD97
Decimal Notation	392,599
Octal	1376627
Binary Numbers	0101111110110010111

b. 0x610A

- The way we will solve this Question is to use the calculator and then we will be able to tell, what the hexadecimal patterns are in binary numbers.

- I have created a table, so we can clearly have an overview over the other things as well.

Numbers in Programming	Answers
Hexadecimal patterns = We write in the calculator	0x610A
Decimal Notation	24.842
Octal	60.412
Binary Numbers	0110000100001010

c. 0X ABCD (Der er afstand fordi Word retter automatisk til små bogstaver).

- The way we will solve this Question is to use the calculator and then we will be able to tell, what the hexadecimal patterns are in binary numbers.

- I have created a table, so we can clearly have an overview over the other things as well.

Numbers in Programming	Answers
Hexadecimal patterns = We write in the calculator	0xABCD
Decimal Notation	43,981

Octal	125715
Binary Numbers	1010101111001101

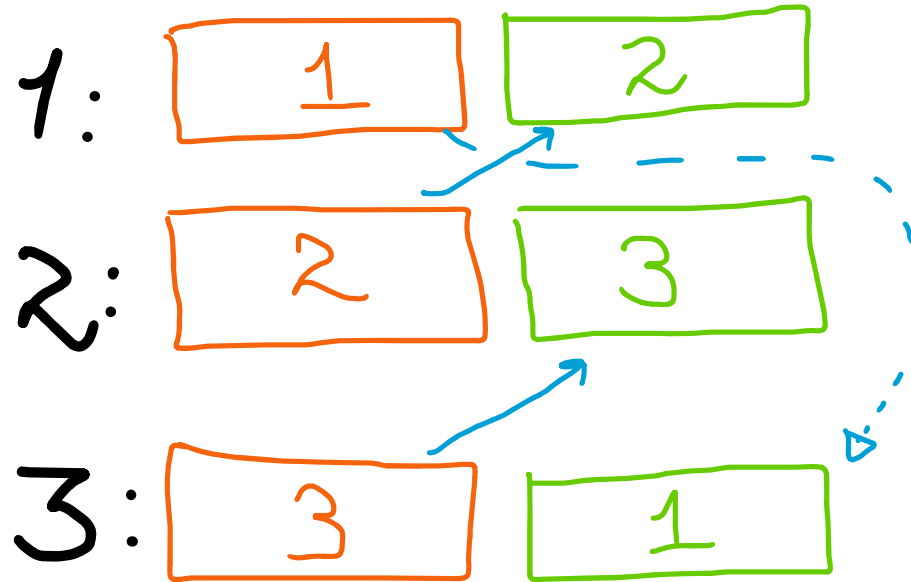
d. 0x0100

- The way we will solve this Question is to use the calculator and then we will be able to tell, what the hexadecimal patterns are in binary numbers.
- I have created a table, so we can clearly have an overview over the other things as well.

Numbers in Programming	Answers
Hexadecimal patterns = We write in the calculator	0x0100
Decimal Notation	X
Octal	X
Binary Numbers	0000000100000000

## Opgave 1.2 - Spørgsmål & Øvelser

1. If the memory cell whose address is 5 contains the value 8, what is the difference between writing the value 5 into cell number 6 and moving the contents of cell number 5 into cell number 6?
  - If I have understood it correct, then it means that if that one cell number 5 contains 6. Then in this case it would be another cell number 5, which will have the number 8 inside.
2. Suppose you want to interchange the values stored in memory cells 2 and 3. What is wrong with the following sequence of steps:
  - In this case, what happens is that the original value of 2 and 3, end up at the same place. And that is because the original value isn't actually gone and makes up all the mistakes.
  - For the following step, we will have to look it like an byte interval. If you get a number which is over the number 128, then you will get a number which will begin in the first place with the number 129 to the next 128 numbers. I will show a example with pictures.



3. Design a sequence of steps that correctly interchanges the contents of these cells. If needed, you may use additional cells.

- I have drawn it above in 1.2.2.

4. How many bits would be in the memory of a computer with 4KB memory?

- Okay, we need to start from the basis. In this case 1 byte is equal to 8 bits. And in this case because we have 4 Kilobytes, then we need to multiply the eight with four (4). This will give us 32. But because we already know that a kilobyte is 1024 bytes, then we will multiply the 32 with 1024 and get 32768 bits.

### Opgave 1.3 - Spørgsmål & Øvelser

1. What is gained by increasing the rotation speed of a disk or CD?

- In this case, we can see that the rotation speed of a disk results that we get the data in a faster way and the storage gets bigger.

2. When recording data on a multiple-disk storage system, should we fill a complete disk surface before starting on another surface, or should we first fill an entire cylinder before starting on another cylinder?

- X

3. Why should the data in a reservation system that is constantly being updated be stored on a magnetic disk instead of a CD or DVD?

- X

4. What factors allow CD, DVD, and Blu-ray disks all to be read by the same drive?

- X

5. What advantage do flash drives have other the mass storage systems introduced in this section.
  - X
6. What advantages continue to make magnetic hard disk drives competitive?
  - X

## Opgave 1.4 - Spørgsmål & Øvelser

1. Here is a message encoded in ASCH using 8 bits per symbol. What does it say? (See Appendix A.)
  - Use the table or the calculator to find the encoded message.

01000011	01101111	01101101	01110000	01110101	01110100
C	O	M	P	U	T
01100101	01110010	00100000	01010011	01100011	01101001
T	E	R	S	C	I
01100101	01101110	01100011	01100101		
E	N	C	E	Alle lille bogstaver	

2. In the ASCH code, what is the relationship between the codes for an uppercase letter and the same letter in lowercase? (See Appendix A.)
  - The difference between the capital letter codes and small letter codes are that the big letters start with 010 and the small letters start with 011.

3. Encode these sentences in ASCH:
  - a. "Stop!" Cheryl shouted.
    - We will use the ASCH table to show how we solve this question.

"	S	t	o	p	"		
00100010	01010011	01110100	01101111	01110000	00100010		
C	h	e	r	y	l		
01000011	01101000	01100101	01110010	01111001	01101100		
s	h	o	u	t	e	d	.

01110011	01101000	01101111	01110101	01110100	01100101	01100100	00101110
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b. Does  $2 + 3 = 5$ ?

- This task will be done on the same manner, as done before. We will use the table again.

2	+	6	=	5	?
00110010	00101011	00110110	00111101	00110101	00111111

4. Describe a device from everyday life that can be in either of two states, such as a flag on a flagpole that is either up or down. Assign the symbol 1 to one of the states and 0 to the other, and show how the ASCH representation for the letter b would appear when stored with such bits.

- X

5. Convert each of the following binary representations to its equivalent base ten form:

- 0101 = 5
- 1001 = 9
- 1011 = 8
- 0110 = 6
- 10000 = 10
- 10010 = 12

6. Convert each of the following base ten representations to its equivalent binary form:

- 6 = 0110
- 13 = 00010011
- 11 = 00010001
- 18 = 00011000
- 27 = 00100111
- 4 = 0100

7. What is the largest numeric value that could be represented with three bytes if each digit were encoded using one ASCH pattern per byte? What if binary notation were used?

- X

8. An alternative pattern.....

- 0000111100001111 = 15.15



b.  $001100110000000010000000 = 51.0.128$

c.  $0000101010100000 = 10.160$

9. What is an advantage of representing images via geometric structures as opposed to bit maps? What about bit map techniques as opposed to geometric structures?

- The advantage of using geometric structures is, that we can get a better visualization of how structures are and their formation. Whereas if we look at the bit numbers, then we get a visualization of how the structure are built in the algebraic form.

10. Suppose a stereo recording of one hour of music is encoded using a sample rate of 44,100 samples per second, as discussed in the text. How does the size of the encoded version compare to the storage capacity of a CD?

- X

## Opgave 1.5 - Spørgsmål & Øvelser

1. Convert each of the following binary representations to its equivalent base ten form:

a.  $101010 = 42$

b.  $100001 = 33$

c.  $101111 = 47$

d.  $0110 = 6$

e.  $11111 = 31$

2. Convert each of the following base ten representations to its equivalent binary form:

a.  $32 = 00110010$

b.  $64 = 01100100$

c.  $96 = 10010110$

d.  $15 = 00010101$

e.  $27 = 00100111$

3. Convert each of the following binary representations to its equivalent base ten form:

a.  $11.01 = 3.4$

b.  $101.111 = 5.E$

c.  $10.1 = 2.8$

d.  $110.011 = 6.6$

e.  $0.101 = 0.A$

4. Express the following values in binary notation:

a.  $4 \frac{1}{5} = 100.0101$

- b.  $2 \frac{3}{4} = 010.01110101$
- c.  $1 \frac{1}{8} = 001.000100100101$
- d.  $5/16 = X$
- e.  $5^{5/8} = 01110010000.011000100101$
- 5. Perform the following additions in binary notation: (Add them, like you do in Maths)
- a.  $11011+1100 = 12.111$
- b.  $1010.001 + 1.101 = 1.011,102$
- c.  $11111+0001=11112$
- d.  $111.11+00.01 = 111.12$

## Opgave 1.6 - Spørgsmål & Øvelser

1. Convert each of the following two's complement representations to its equivalent base ten form:
  - a.  $00011 = 3$
  - b.  $01111 = 15$
  - c.  $11100 = -4$
  - d.  $11010 = -6$
  - e.  $00000 = 0$
  - f.  $10000 = -16$
2. Convert each of the following base ten representations to its equivalent two's complement form using patterns of 8 bits:
  - a.  $6 = 0000000000000110$
  - b.  $-6 = 1111111111111010$
  - c.  $-17 = 1111111111101111$
  - d.  $13 = 0000000000001101$
  - e.  $-1 = 1111111111111111$
  - f.  $0 = 0000000000000000$
3. Suppose the following bit patterns represent values stored in two's complement notation. Find the two's complement representation of the negative of each value.
  - a.  $00000001 = 1$
  - b.  $01010101 = 85$
  - c.  $11111100 = 252$
  - d.  $11111110 = 254$
  - e.  $00000000 = 0$
  - f.  $01111111 = 127$

4. Suppose a machine stores numbers in two's complement notation. What are the largest and smallest numbers that can be stored if the machine uses but patterns of the following lengths?
- Four = 0100
  - Six = 0110
  - Eight = 1000
5. In the following problems, each but pattern represent a value stored in two's complement notation. Find the answer to each problem in two's complement notation by performing the addition process described in the text. Then check your work by translating the problem and your answer into base ten notation.
- To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
<b>0101 + 0010 = 0111</b>	<b>5 + 2 = 7</b>

- To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
<b>0011 + 0001 = 12</b>	<b>3 + 1 = 4</b>

- To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
<b>0101 + 1010 = 1111</b>	<b>5 + (-6) = -1</b>

- To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
<b>1110 + 0011 = 1121</b>	<b>6 + (-5) = 1</b>

- To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
<b>1010 + 1110 = 2120</b>	<b>2 + 6 = 8</b>

6. Solve each of the following problems in two's complement notation, but this time, watch for overflow and indicate which answers are incorrect because of this phenomenon.

a. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$0100 + 0011 = 0111$	$-4 + (-5) = -9$

b. To solve the Question, we need to create a table that can show how we solve this question. (Overflow)

Addition	Answer in Decimals
$0101 + 0110 = 211$	$-3 + (-2) = -5$

c. To solve the Question, we need to create a table that can show how we solve this question. (Overflow)

Addition	Answer in Decimals
$1010 + 1010 = 2020$	$2 + 2 = 4$

d. To solve the Question, we need to create a table that can show how we solve this question. (Overflow)

Addition	Answer in Decimals
$1010 + 0111 = 1121$	$2 + (-1) = 1$

e. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$0111 + 0001 = 0112$	$-1 + (-7) = -8$

7. Translate each of the following problems from base ten notation into two's complement notation using bit patterns of length four, then convert each problem to an equivalent addition problem (as a machine might do) and perform the addition. Check your answers by converting them back to base ten notation.

a. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$6 - (-1) = 7$	$0110 + 0001$

- b. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$3 - (-2)$	$0011 + 1110$

- c. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$4 - 6$	$0100 + 1010$

- d. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$2 - (-4)$	$0010 + 0100$

- e. To solve the Question, we need to create a table that can show how we solve this question.

Addition	Answer in Decimals
$1 - 5$	$0001 + 1011$

8. Can overflow ever occur when values are added in two's complement notation with one value positive and the other negative? Explain your answer.

- No, when a number is too big, to be stored, then the number can't be overflowed.

9. Convert each of the following excess eight representations to its equivalent base ten form without referring to the table in the text:

- a.  $1110 = 6$
- b.  $0111 = -1$
- c.  $1000 = 0$
- d.  $0010 = 2$
- e.  $0000 = -8$

f.  $1001 = 1$

10. Convert each of the following base ten representations to its equivalent excess eight form without referring to the table in the text:

a.  $5 = 1101$

b.  $-5 = 0011$

c.  $3 = 1011$

d.  $0 = 1000$

e.  $7 = 1111$

f.  $-8 = 0000$

11. Can the value 9 be represented in excess eight notation? What about representing 6 in excess four notation? Explain your answer.

- The number nine can be expressed, but not directly. The only way to add nine is to take additional numbers and put them together which results in 9.
- Whereas if look at 6, then we can see that we will have to use the same method because we don't have direct four notation, which can give us 6.

## Opgave 1.7 - Spørgsmål & Øvelser

1. Decode the following bit patterns using the floating-point format discussed in the text:

a.  $01001010 = 74$

b.  $01101101 = 109$

c.  $00111001 = 57$

d.  $11011100 = 220$

e.  $10101011 = 171$

2. Encode the following value into the floating-point format discussed in the text. Indicate the occurrence of truncation error.

a.  $2\frac{3}{4} = 01101011$

b.  $5\frac{1}{4} = 01111010$  (*error*)

c.  $\frac{3}{4} = 01001100$

d.  $-3\frac{1}{2} = 11101110$

e.  $-4\frac{3}{8} = 11111000$  (*error*)

3. In terms of the floating-point format discussed in the text, which of the patterns 01001001 and 00111101 represents the larger value? Describe a simple procedure for determining which of two patterns represents the larger value.

- If we look closer towards the numbers of these patterns, then we can see that because the number 01 begins first then it is larger than 0011.

4. When using the floating-point discussed in the text, what is the largest value that can be represented? What is the smallest positive value that can be represented?
- X

## Opgave 1.8 - Spørgsmål & Øvelser

1. What makes Python an interpreted programming language?
  - The reason behind that Python is an interpreted language, is because Python instructions can be typed into an interactive prompt or can be stored in a plain text file (called a script) and run later.
2. Write Python statements that print the following:
  - a. The words “Computer Science Rocks”, followed by an exclamation point.

```
1 print("Computer Science Rocks")
>>> %Run -c $EDITOR_CONTENT
Computer Science Rocks
>>>
```

- b. The number 42.

```
1 print("42")
>>> %Run -c $EDITOR_CONTENT
42
>>>
```

- c. An approximation of the value of Pi to 4 decimal places.

```
1 print("3.1415")
>>> %Run -c $EDITOR_CONTENT
3.1415
>>>
```

3. Write Python statements to make the following assignments to variables:
  - a. The word “programmer” to a variable called, rockstar.

```
1 rockstar = print("programmer")
```

```
>>> %Run -c $EDITOR_CONTENT
```

```
programmer
```

```
>>>
```

- 
- b. The number of seconds in an hour to a variable called seconds\_per\_hour.

```
1 seconds_per_hour = print(60*60)
```

```
>>> %Run -c $EDITOR_CONTENT
```

```
3600
```

```
>>>
```

- 
- 4. Write a Python statement that given an existing variable called bodyTemp in degrees Fahrenheit stores the equivalent temperature in degrees Celsius to a new variable called metricBodyTemp.

```
1 metricBodyTemp = (bodyTemp - 32) / 1.8
```

- 

## Opgave 1.9 - Spørgsmål & Øvelser

1. List four generic compression techniques.
  - The four generic compression techniques are written in the text from page 91. In this case we can see that we have got run.length encoding, frequency-dependent encoding, relative encoding, and the final is dictionary encoding.
2. What would be the encoded version of the message xyx yxxxy xyx yxxxy yxxxy - if LZW compression starting with the dictionary containing x,y, and a space (as described in the text), were used?
  - We know that the beginning, that the letters xyx are equal to 121, because it is mentioned in the text. But I don't know the other part.
3. Why would GIF be better than JPEG when encoding color cartoons?
4. Suppose you were part of a team designing a spacecraft that will travel to other planets and send back photographs. Would it be a good idea to compress the photographs using GIF or JPEG's baseline standard to reduce the resources required to store and transmit the images?
  - According to the text in page number 94, the short form for GIF is equal to Graphic Interchange Format and pronounced Giff. In this case we can see, that GIF is a lossy compression system when applied to arbitrary images because the colors in the palette may not be identical to the colors in the original image. In many films it is also seen that NASA's American Flagpole has turned black and white on the moon's surface.
5. What characteristic of the human eye does JPEG's baseline standard exploit?
  - When the color changes in front of the human eye, then it is less sensitive. This means, that the human eye can easily observe the color change.
6. What characteristic of the human ear does MP3-exploit?
  - According to the book, it is said temporal masking and frequency masking.
7. Identify a troubling phenomenon that is common when encoding numeric information, images, and sound as bit pattern.
  - X



## Opgave 1.10

1. The following bytes were originally encoded using odd parity. In which of them do you know that an error has occurred?

- a. 100101101
- b. 100000001
- c. 000000000
- d. 111000000
- e. 011111111

- The marked red answers show that there is a truncation error occurring. Remembering from the task, that we solved from the practicing examples, that whenever we get a five-digit number delegates at the mantissa, then it results with a truncation error.
- Therefore, we can in this case see, that we have got a 1 in the end, which does not give any sense.
- Thereafter we can see that we have only zeros in c, which does even give sense, because we don't have any Mantissa.
- After that we can see an example of truncation error which we saw from our practicing examples, which in this case is that we have more than 4 ones in the Mantissa.

2. Could errors have occurred in a byte from Question 1 without your knowing it? Explain your answer.

- If more even numbers of truncation errors occur in one byte, as an example 0000000000. Then the parity technique does not detect them.

3. How would your answers to Questions 1 and 2 change if you were told that even parity had been used instead of odd?

- X

4. Encode these sentences in ASCII using odd parity by adding a parity by adding a parity but at the high-order end of each character code:

- X

5. Using the error-correcting code presented in Figure 1.27, decode the following messages:

- X

6. Construct a code for the characters A, B, C and D using bit patterns of length five so that the Hamming distance between any two pattern is at least three.

- X

## Opgave 2.1 - Spørgsmål & Øvelser

1. What sequence of events do you think would be required to move the contents of one memory cell in a computer to another memory cell?

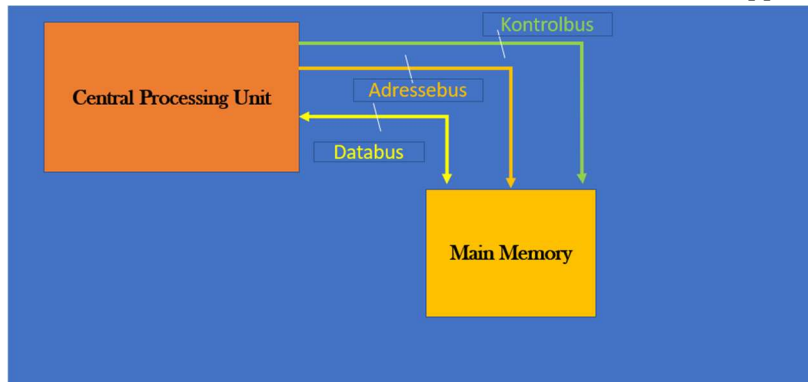
- According to my notes to chapter 2, it is written in page number 117 that when we transfer data between the CPU and the Main Memory, then a General Request is called from the General-Purpose Register, if the GPR is filled with contents from the memory cells, then it is LOAD. If the Memory Cells are filled with GPR, then it is STORE.

- **$GPR \rightarrow MM = LOAD$**

- **$GPR \leftarrow MM = STORE$**

2. What information must the CPU supply to the main memory circuitry to write a value into a memory cell?

- Looking at my notes from the class, we can look at the picture above and see that there are three busses, where two busses (Adress- and Controlbus) is controlled by the CPU to deliver things to the main memory. In this case we can specifically see, that the control bus has to functions, where the first **one is to read or write**, and when is it applicable.



- 
- 3. **Mass storage, main memory, and general-purpose registers are all storage systems. What is the difference in their use?**
- Main memory tells where the things should be store in the memory box. The general-purpose registers are all those which puts the data or the contents inside the memory from CPU-side. Whereas the mass storage is where all the memory is located and can be founded like in shelves.

## Opgave 2.2 - Spørgsmål & Øvelse

1. **Why might the term move be considered an incorrect name for the operation of moving data from one location in a machine to another?**
  - The reason behind, that the term “move” might be considered an incorrect name is become we can state that we are trying to move the memory out of the memory vole simulator. Therefore, it can be very misinterpreted. But there are also other facts, and those are that moving something from one address to the other does not always have to be considered as move but can also be considered as a cloning of a value which is being copied of to the other address.
2. **In the text, JUMP instructions were expressed by identifying the destination explicitly by stating the name (or step number) of the destination within the JUMP instruction (for example, “Jump to Step 6”). A drawback of this technique is that if an instruction name (number) is later changed, we must be sure to find all jumps to that instruction and change that name also. Describe jumps to that instruction and change the name also. Describe another way of expressing a JUMP instruction; instruction so that the name of another way of expressing a JUMP instruction so that the name of the destination is not explicitly stated.**
  - So technically speaking, we can say that when we jump from address to the other then many readers can misinterpret that we are “moving” from one place to the other. But we are jumping over the different addresses. So, when an address appears in between the departing destination and landing destination - then we can’t jump forward or backwards because there is a chance that there is not place to jump forward to.
3. **Is the instruction “If 0 equals 0, then jump to Step 7” a conditional or unconditional jump? Explain your answer.**

- This is either a conditional or an unconditional jump. According to the book, it is meant that because the condition that 0 is equal to 0 - then the jump will happen not matter what happens. According to the books answer sheet, it is meant that many machines in the industry have got many repositories which are able to do any job if there is no condition.

4. **Write the example program in Figure 2.7 in actual bit patterns.**

- So, I have decided to write the following bit patterns from page 121.

0x156C = 000101011101100

0x166D = 0001011001101101

0x5056 = 010100001010110

0x306E = 0011000001101110

0xC000 = 1100000000000000

5. **The following are instructions written in Vole machine language. Rewrite them in English.**

- So, because we want to turn them in ASCII characters, then we need to convert them from Hexadecimal to ASCII-Characters.

a. **0x368A**

- First start by looking at the first number at the x.
- We can in this case see, that the Hexadecimal starts with 3 and therefore it would become Store.
- Interpret: Store the bit pattern found in Register 6 in the Memory Cell whose address is 8A.

b. **0xBADE**

- First start by looking at the Letter after x.
- We can in this case see, that the Hexadecimal starts with B and therefore it would become Jump.
- In this case it would become Jump.

c. **0x803C**

- First start by looking at the Letter after x.
- We can in this case see, that the Hexadecimal starts with 8 and therefore it becomes AND.

d. **0x40F4**

- First start by looking at the Letter after x.
- We can in this case see, that the Hexadecimal starts with 4 and therefore it become Move.

6. **What is the difference between the instructions 0x15AB and 0x25AB in Vole?**

- According to page number 121, the Load Instruction has to op-code values. One is with 0x1 and the second one is 0x2.
- **OX1:** If any instruction has 0x1, then it means that (it) loads the register with contents of Memory Cell.
- **OX2:** If any instruction has 0x2, then it means that (a) identifies an instruction that loads a Register with a Particular Value.
- We can clearly see according to page number 12, the difference is that the operand field in an instruction of the first type contains an address, whereas in the second type, the operand field contains the actual bit pattern.

7. Here are some instructions in English. Translate them each of them into Vole machine language.

a. **LOAD** register number 0x3 with the hexadecimal value 0x56.

- In this case we need to take the hexadecimal values 0x3 and 0x56. Combine them together, which gives us 0x356. Thereafter look at the COS04 Presentation under the Vole Instructions. There we can find the second example and see that there has been added a 2 number in front. Therefore, it is 0x2356.

b. **ROTATE** register number 0x5 three bits to the right.

- We will use the same method of guessing. In this case we can see that we need to rotate, and we have already got a hexadecimal value after the x-mark. Therefore, we will in the end write 03 as given in the Presentation Example.
- In the end our guessing becomes: 0x503.

c. **AND** the contents of register 0xA with the contents of register 0x5 and leave the result in register 0x0.

- In this case we can see that we have got the following values: 0x0, 0x5 and 0xA according to hexadecimal system. So, until now we have got 0x05A, but a value between x and 5 is missing.
- According to the answer sheet, it is meant that the final answer is 0x805A.

## Opgave 2.3 - Spørgsmål & Øvelser

1. Suppose the Vole memory cells from addresses 0x00 to 0x05 contain the bit patterns given in the following table:

Address	Contents
0x00	0x14
0x01	0x02
0x02	0x34
0x03	0x17
0x04	0xC0
0x05	0x00

If we start the machine with its program counter containing 0x00, what bit pattern is in the memory cell whose address is 0x17 when the machine halts?

- Usually, the machine will halt at the beginning at 0x34 because that is not 0x17.

2. Suppose the Vole memory cells at addresses 0xB0 to 0xB8 contain the bit patterns given in the following table.

Address	Contents
0xB0	0x13
0xB1	0xB8
0xB2	0xA3
0xB3	0x02
0xB4	0x33
0xB5	0xB8

0xB6	0xC0
0xB7	0x00
0xB8	0x0F

- If the program counter starts at 0xB0, what bit pattern is in register number 0x3 after the first instruction has been executed.
  - In this case it will become 0x0F.
- What bit pattern is in memory cell 0xB8 when the halt instruction is executed?
  - In this case it will become 0xC3.
- Suppose the Vole memory cells at addresses 0xA4 to 0xB1 contain the bit patterns given in the following table:

Address	Contents
0xA4	0x20
0xA5	0x00
0xA6	0x21
0xA7	0x03
0xA8	0x22
0xA9	0x01
0xAA	0xB1
0xAB	0xB0
0xAC	0x50
0xAD	0x02
0xAE	0xB0
0xAF	0xAA
0xB0	0xC0
0xB1	0x00

When answering the following questions, assume that the Vole is started with its program counter containing 0xA4.

- What is in register 0x0 the first time the instruction at address 0xAA is executed?
- What is in register 0x0 the second time the instruction at address 0xAA is executed?
- How many times is the instruction at address 0xAA executed before the Vole halts?

### Opgave 3.1 - Spørgsmål & Øvelser

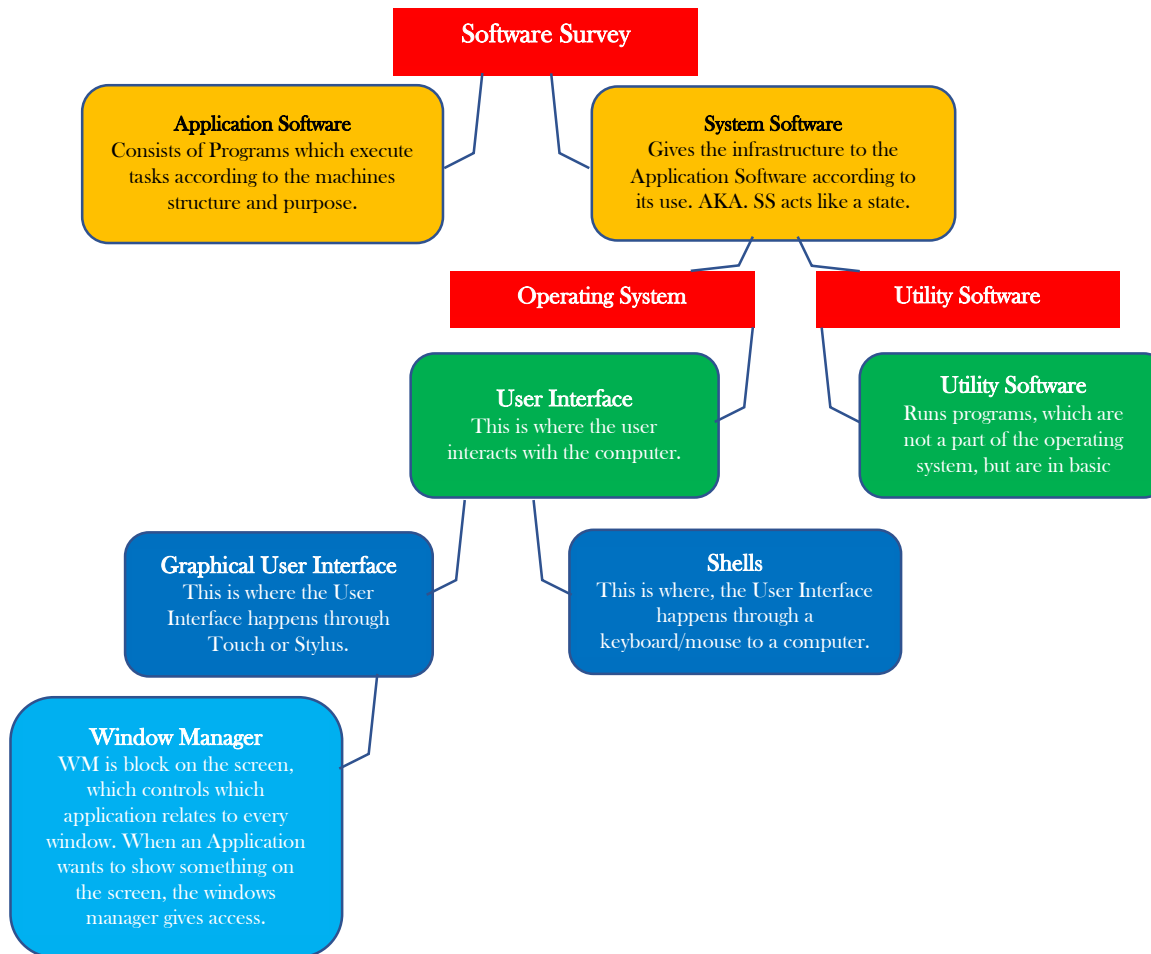
- Identify examples of queues. In each case, indicate any situations that violate the FIFO structure.
  - When we print something on a copy machine, then the chance of something which can violate the FIFO-Structure is quite big. We usually see on the printer queues in desktop computers, that there are some files which are being waited to be printed.
  - Remember always that the definition of FIFO is First-In-First-Out, also known in Danish as “Stik-Ind-Stik-Ud” 😊.
- Which of the following activities require real-time processing?

- a. **Printing mailing labels**
- b. **Playing a computer game**
- c. **Displaying numbers on a smartphone screen as they are dialed**
- d. **Playing an MP3 recording**

- Real-Time Processing means that the actions/work which has been conducted is being done in Real-Time. This means, that the PC need to execute/do work within a specific deadline from the real world.
  - For example, when we usually set a timer in our iPhone's, then the machinery inside does real-time processing where it counts down according to the time, the user has requested it to do.
3. **What is the difference between embedded systems and PCs?**
- According to my notes, the devices which have systems and are dedicated to something specific work, and a certain operative system embedded. This is called Embedded Systems, which can be read about in page number 168 where it is explained.
  - Whereas if we look at the definition of PC, which stands for Personal Computer and that is wider aspect of the difference between the two words.
  - So, in total we can say that embedded systems are those which are inside the PC and are making it function. Whereas the PC is all the embedded systems gathered and made into a whole unit display.
4. **What is the difference between time-sharing and multitasking?**
- Time sharing is where we create a specific interval where the task needs to be executed. Thereafter we can go forward to another task.
  - If you look closer towards multitasking, then it is when we are executing several tasks at the same time. This means on task is being executed while the other has just entered and so on. Consider it like a machine factory 😊

## Opgave 3.2 - Spørgsmål & Øvelser

1. List the components of a typical operating system and summarize the role of each in a single phrase.
  - To make it simpler, I have decided to draw a picture over the structure with the definitions.



2. **What is the difference between application software and utility software?**

- According to page number 169, 170 and 171, there are two categories under the operating system. In this case we have the Application Software System and System Software.
- **Application Software:** As shown on the picture above Application Software consists of the programs for performing tasks particular to the machine's utilization. A machine used to maintain the inventory for a manufacturing company will contain different application software from that found on a machine used by a electrical engineer. As an example, we can see, that the examples from the book on page 170 include spreadsheets, database systems, desktop publishing systems, accounting systems, program development and games so on.
- **System Software:** Software System can be considered as the infrastructure of the different applications in the operating system. In this case the System Software can as explained in page 170, be recognized as a embodiment of a nation, which consists of different institutions and ministries. It should be noted that there are subcategories such as utility software which comes under the System Software.

3. **What is virtual memory?**

- Okay let me explain it this way. Whenever the system exceeds the Storage of the Main Memory, then usually the Main Memory uses a technique where it creates an illusion for its data, where it creates extra Memory Space. This happens through Rotating of the different programs and Data back and forth between the Main Memory and Mass Storage which is called for Paging and there is also given an Example in the book.
- But to be clear, the illusion which the Main Memory creates is called for the Virtual Memory.

4. **Summarize the booting procedure.**

- The booting procedure can be explained in the following simplified words: Whenever a person restarts his/her computer, the Volatile Memory of the Computer is Erased each time the machine is turned off. This is a problem because the CPU expects to start a program whenever it wants to start its work. Therefore, a small portion of the nonvolatile memory cells, which is also known as read-only memory (ROM). These small portions of cells can't be changed or altered and therefore they can only be read. It should be noticed that these nonvolatile memory cells are mostly constructed from the PC's flash memory technology in the modern-day world. If we go further, then we can see that in the general-purpose computer, a program called the bootloader is permanently stored in the Machines ROM, this boot loader is executed when the machine is on. When the machine is on, the Bootloader directs the CPU to transfer the operating system from a predetermined location into the volatile are of the main memory. Once the main operating system has been placed in the main memory, the boot loaders direct the CPU to execute a jump instruction to the area of the main memory. From this point, the main memory takes over the controlling of the machine's activities and the overall process of executing the bootloader and then in the end starting the operating system.

## Opgave 3.3 - Spørgsmål & Øvelser

1. **Summarize the difference between a program and a process.**

- A program is a representation, and a process is something which runs the program.
- A program can be an equation or a sentence, but a process is something which executes that's equation or sentence, so we get a result in a form of an output.

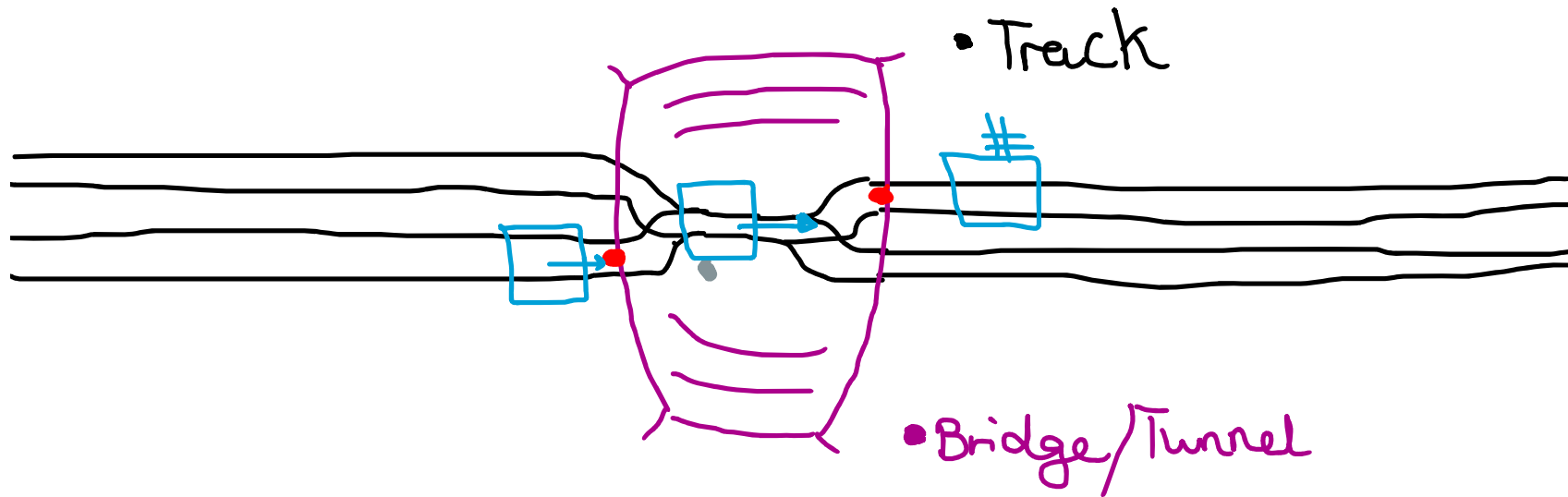
2. **Summarize the steps performed by the CPU when an interrupt occurs.**



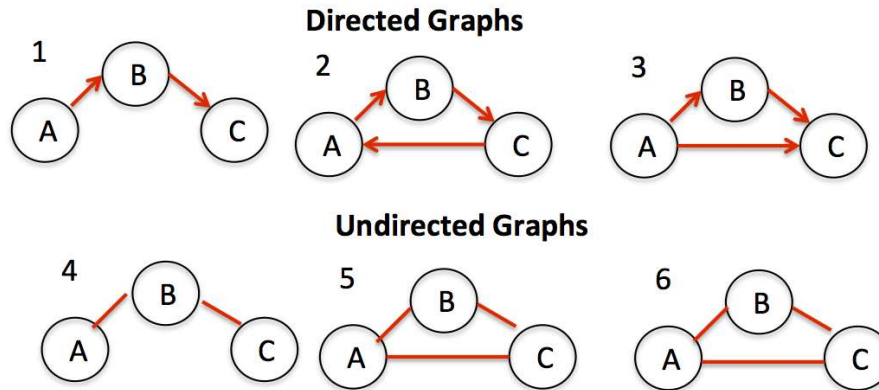
- Whenever a Dispatcher is used for the time slicing, then we need to set an alarm to set the stop of the time. This is where the interrupt or as I call it an Interrupter comes in. Whenever a signal comes from the interrupter to the CPU, the CPU finishes the machine cycle and receives and saves the interrupt in a position in current process. Thereafter the CPU executes the program, which is also known as the interrupt handler where it saves it in a predetermined location in the Main Memory.
- 3. **In a multiprogramming system, how can high-priority processes be allowed to run faster than others?**
  - One of the reasons behind a high-priority process can be allowed to run faster than others, is either because they have got longer time slices or they have got a higher priority value from the dispatcher.
- 4. **If each time slice in a multiprogramming system is 50 milliseconds and each context switch requires at most a microsecond, how many processes can the machine service in a single second?**
  - According to the answer sheet, we have got 20 processors.
- 5. **If each process uses its complete time slice in the machine in Question 4, what fraction of the machine's time is spent actually performing processes? What would this fraction be if each process executed an I/O request after only a microsecond of its time slice?**
  - X

### Opgave 3.4 - Spørgsmål & Øvelser

1. **Suppose process A and process B are sharing time on the same machine, and each needs the same non-shareable resource for short periods of time. (For example, each process may be printing a series of independent, short reports.) Each process may then repeatedly acquire the resource, release it, and later request it again. What is a drawback to controlling access to the resource in the following manner:**
  - So, to formulate the Question better, it is directly saying that when a process is finished doing its work and has needed the non-shareable resources - what is the disadvantage then?
  - The disadvantage is that FIFO rule and then Interrupt Rule can be applied here, because once a process is finished using a machine then the process needs to go back at the queue and stand in line again to use the machine. So is the rule also applicable for those processes, which need the machine or resource straight away. (They still must wait at the queue for their turn.)
2. **Suppose a two-lane road converges to one lane to pass through a tunnel. To coordinate the use of the tunnel, the following signal system has been installed. - What is the flaw in this system?**



- Looking at the picture, then you can see that the black tracks are the rails which are being converge into one track, in the purple tunnel.
  - In this case we can see, that when the train enters the tunnel, the lights are turned red and then are turned off when the train is inside.
  - The flaw with this system is that when a train from the opposite side enters at the same time with the each other then they aren't aware of the situation of that there is a collision between the trains. And that is because, that the train from the other side can easily think that there is no read light, which means that there is a clear passage through the tunnel even though it isn't clear.
  - We can say that our trains are the process, and the bridge is our executor. So, there is a reference to a difficult process.
3. Suppose the following solutions have been proposed for removing the deadlock that occurs on a single-lane bridge when two cars meet. Identify which condition for deadlock given in the text is removed by each solution.
- a. Do not let a car onto the bridge until the bridge is empty.
    - So, to formulate this question, they are saying either give the whole bridge to one car at a time or else do not give nothing at all.
  - b. If cars meet, make one of them back up.
    - This creates a parameter, where we can see that one non-shareable resource can be forced directly to be executed.
  - c. Add a second lane to the bridge.
    - This destroys the Deadlock concept, which is good. When we have two lanes inside the bridge, then we can easily let non-shareable resources go through, which then removes the competition for using one intersection point.
4. Suppose we represent each process in a multiprocessing system with a dot and draw an arrow from one dot to another if the process represented by the first dot is waiting for a (non-shareable) resource being used by the second. Mathematicians call the resulting picture a directed graph. What poverty of the directed graph is equivalent to deadlock in the system?



- 
- Looking at the picture above, we can clearly see that directed graphs are there where we have arrows pointing at one circle and then the other.
- Whereas undirected graphs are, those graphs which are connected to each other, but don't show the pointing or as "I" shall call it, the "no sign of flow of the system"!
- If we compare these terminologies with the Deadlock-Concept, then we can see that Directed Graphs are an example of the conditions which were explained in page number 183, where there are creating Avoiding Schemes to prevent Deadlock from happening.
- Looking over towards the comparison with the Undirected Graphs with the Deadlock, then we can see that we aren't getting any sign of "if" there are any conditions or a direction on the graph. Therefore, we can say that a Deadlock is taking place, in the Undirected Graphs.

### Opgave 3.5 - Spørgsmål & Øvelser

1. **Give some examples of poor choices for passwords and explain why they would be poor choices?**
  - So, the question here is saying what is poor suggestion for creating a password, and what is the reason behind it?
  - In this case we can say that passwords which are very closely related to the user is considered a weak/unsafe password. In this case it could be a name or an institution which could easily be guessed by a foreign person.
  - A good suggestion for a strong password, would be different from the name, date, institution etc. Instead to create a strong password, it would suggest creating a password with numbers and letters combined so it could become a puzzle came for an intruder to guess your code!
2. **Processor in the Intels' Pentium series provide for four privilege levels. Why would the designers of CPU's decide to provide four levels rather than three or five?**
  - This Question relates a lot to the concept of bit-pattern. Here we can see that the number 4 of the privilege levels is the number of different bit patterns that can be formed using 2 bits. If we would say that we would like to have more privilege, then maybe some designers would suggest that we need at least 3 bits to represent the different levels and would then mostly prefer to use a total of 8 levels.
  - The same concept can be used for fewer privileges, and here we can see that we might instead of using 4 privilege levels, would then instead use 2.
  - Look at the page 692 answer sheet!

**3. If a process in a multiprogramming system could access memory cells outside its allotted area, how could it gain control of the machine?**

- So, looking at the page 188, we can see that the Administrator is known as the superuser, but sometimes there are some hackers which try to gain access to the computer system. In this case we can see that they want to try to change the register purpose, which does that it suddenly requires more space in the memory cells. To save ourselves from these actions, it is important to know something about the privilege levels. Here in this case, we can see that we have non-privilege levels and privilege levels. In this case we can see that the CPU can decide its privilege levels through privilege mode. This means, that whenever someone else is trying to change the privilege mode of the CPU, the operating system is informed and then the Operating System will be able to maintain the control or take the control back of the integrity of the computer system.

## **Opgave 4.1 - Spørgsmål & Øvelser**

**1. What is an open network?**

- We have in this case two forms of network. In this case we can see, that the two categories are an open network and a latter network / Proprietary Network.
- The characteristics of Open Network designs are that they are free to circulate and grow in popularity to the point, where it is overwhelming over the latter network.

**2. Summarize the distinction between a bridge and a switch.**

- The Bridge has the same job, as a Repeater but the distinction is that the Bridge looks after the destination address for the specific message and thereafter forwards the message which is meant to be at the other side of the computer. (According to page 202).
- Whereas if we look closely towards the switch, then we can see that it also has the same work as the Bridge, but it sends the messages forward towards the spokes.

**3. What is a router?**

- The characteristic of a router is, that is special computers which forwards messages, but distinct themselves from Repeaters as they release links between Networks, while it permits every network to keep its internal characteristics.
- The way I usually remember Router is, that it functions like a meeting point/airport, where it directs messages/flights inside a country in a domestic form and as flights/message towards the outside or international places.
- Looking at the page number 204. In this case, we can see that the Router forwards messages in a proper direction, in which the internet-wide system is based on. Machines with Routers have an internal Address and an Outer Address. What really happens is, that whenever we for example want to search (Google), it starts the Machine by sending the message to the local router. Then it forwards message to the Router, where it forwards in another proper direction and thereafter in a Network, where Google is in the near!

**4. Identify some relationships in society that conform to the client/server model.**

- So let me explain it in this way. Many activities are being executed in different computers and in different networks. Many computers work closer together, through a communication, to receive messages or processes which are maybe being transferred to a particular computer. In this case we can see that this form of communication is called for Inter process Communication. This Inter Process Communication Model consists of Client/Server Model. Here the process role is either played by the client or the server. In this case we can take the example of the relationship between a Computer and a Printer, where it is clearly seen that the Printer is the Server because it is available for printing, whereas the Computer is the Client because it wants to print something from the Computer.

**5. Identify some protocols used in society.**

- Some of the protocols or “rules” as I shall call it, which are used in the society are: Verbal communication, etiquette and so on.

**6. Summarize the distinction between cluster computing and grid computing.**

- In this case, we can see that cluster computing is where dedicated computers work to provide high-availability or load-balanced distribute programming. Whereas Grid Computing are more loosely coupled, compared to Cluster Computing. Here it can be seen that this could involve machines that join the distributed computation when they are otherwise idle.

## Opgave 4.2 - Spørgsmål & Øvelser

**1. What is the purpose of tier-1 and tier-2 ISPs? What is the purpose of access ISPs?**

- According to page number 209, we can see that the Internet Service Providers (ISPs) where a hierarchy is constructed to show which role they can play in the ISPs structure. In this case, in the top of the hierarchy we have Tier 1-ISPs, Tier-2 ISPs, Access ISPs and then End systems.
- **Tier-1-ISPs:** Consist of very high-speed, high-capacity, international WANS. It is said that these networks are thought of as the backbone of the Internet, where they are operated by large companies which are in the business market.
- **Tier-2-ISPs:** Considered to be a regional Scope, where it is less potent in their capabilities.
- **DISTINCTION:** The distinction between the tier-1 and tier-2 ISPs is more related towards the communication. Whereas the access IPSs provide access to that the core to their customers.

**2. What is DNS?**

- Looking at page number 213, then it can be see that the full form for DNS is Domain Name System (DNS). The DNS-System is the Internet-wide collection of name servers that allow translation from mnemonic addresses to IP addresses (and in the other direction as well).

**3. What bit pattern is represented by 3.6.9 in dotted decimal notation? Express the bit pattern 0001010100011100 using dotted decimal notation.**

- The expression 3.6.9 represents the three-byte pattern of 000000110000011000001001. The bit pattern 0001010100011100 would be represented as 21,28 in dotted decimal notation.

**4. In what way is the structure of a mnemonic address of a computer on the Internet (such as overthruster.propulsion.yoyodyne) similar to a traditional postal address? Does this same structure occur in IP addresses?**

- So we can in this case see, that the overthruster.propulsion are considered to be the subdomain here, as they are in a subcategory inside a website of the primary domain yoyodyne.com. Remember that top-level domains are those which are called .edu and .gov which are dedicated for referring to an institution or a government website. Whereas Country code TLDs are .dk for Denmark, .in for India and .us for USA.

**5. Name three types of servers found on the Internet and tell what each does.**

- According to page number 215, the FTP is a server which is used for copying files across the network. Whereas the SMTP is defined a way that two computers on the network may interact when transmitting an email message from one host to the other.

**6. What aspects of network communication are described by a protocol?**

- Protocols which describe Network Communication are used for the protocols for describing the format of messages which are being exchanges. We can consider this context to be, where the message is sorted and ordered in a certain manner.

**7. In what way do the P2P and multicast approaches to Internet radio broadcast differ from N-unicast?**

- First, we need to understand the difference between the three words:
- Unicast is where a sender, sends a message to a receiver.
- N-Unicast is a sender, which sends a message to a lot of receivers at the same time.
- P2P model is the model, which replaces the client server model in terms of distribution/sharing. The main reason is because it distributes service task over many Peers, then concentrating only to one single Server.
- Whereas if we look closer towards the multicast, then we can see that it transfers the distributions problem to the Internet Routers. The use of Multicast results on a server transmitting one message to more clients under one address, where it depends on the router of the internet to recognize the significance of the address and produce with forwarding copies of message to the right Destinations.
- Looking, at these things we can see that the burden of sending individual messages gets reduced. In which way, you might ask and that is that the workload gets shifted to the clients, whereas if you look closer towards the multicast then you can see that it shifts this burden to internet routers.

**8. What criteria should one consider when choosing one of the four types of VoIP?**

- In this case we can see that whenever we need to consider the criteria of choosing a specific VOIP out of the four, then we need to have a closer look at the cost, connectivity of using the computer with our phone, and the need to use electronic devices in emergency situations.

## **Opgave 4.3 - Spørgsmål & Øvelser**

**1. What is a URL? What is a browser?**

- URL or also called Uniform Resource Locator (URL). In the book it says that every Document on the web, has an Address which is called URL.
- If you look towards page 220, then you can see that if a user wants to access the hypertext page, he/she has to go through the internet. In this case we have browser and web servers, where browsers in this case resides on the user's computer and is charged with the tasks of obtaining materials requested by the user and presenting these materials to the user in a organized manner in Common Internet browsers such as Chrome, Edge, Firefox etc.

**2. What is a markup language?**

- Many people consider HTML and CSS for Programming languages, but that is wrong! These languages are marked up languages, which means that we do not define something inside a method. We do not want them to give us a result, but instead we want them to present us something in a forum.

**3. What is the difference between HTML and XML?**

- HTML is known as the Hypertext Markup Language, where there are tags that describe how the documents appearance should be on a display screen. And because each document is attached to each other, then this explains the concept of HTML.

**4. What is the purpose of each of the following HTML tags?**

- a. `<html>` = It is to declare the Doctype.
- b. `<head>` = It is to give a heading. You can also write h1, h2 and so on.
- c. `</p>` = It is where you write an explaining text.
- d. `</a>` = This is an anchor tag, where links are attached.

**5. To what do the terms client side and server side refer?**

- Client Side is where the computer is and where user is using the net. Whereas the server side is the net-side, where you have come to.

## Opgave 4.4 - Spørgsmål & Øvelser

1. **What layers of the Internet Software Hierarchy are not needed at a router?**
  - There are two layers which used for receiving the message. In this case we can see that the link layer receives the message and then hands it over to the network layer. The network layer afterwards decides which direction is going to be sent to. Thereafter the network layer gives the message back to the link layer to be forwarded.
  - According to the book, higher layers such as the Application Layer and Transport Layer is not needed that much, but sometimes advanced routers have the capability to have more functions as these.
2. **What are some differences between a transport layer based on the TCP protocol and another based on the UDP protocol.**
  - So, there are two subcategories of the transport layer and these basically determines "Like" which company you would prefer to travel with. In this case we can see that TCP is a reliable protocol, which notifies the sender before sending the message. Whereas the UDP just sends the message and does not notify the sender and forgets about it (unreliable).
  - If there are any problems send a message over the router, the TCP might change the speed of the execution of its message to make sure it has passed through, this is called a reliable protocol whereas the UDP does not compromise and sends it right away.
  - But UDP is not always bad, whenever we want to stream videos or something online, then we would mostly prefer UDP than TCP as it is faster than TCP.
3. **How does the transport layer determine which unit with the application layer should receive an incoming message?**
  - So, looking at the page number 233, the determination of which unit the application should receive an incoming message is an important task of the transport layer. This happens by assigning unique port numbers to various units and requiring that the appropriate port number be appended to messages address before starting the message on its journey. Once the message is received by the transport layer at the destination, the transport layer merely hands the message to the application layer at the designated port number.
4. **What keeps a computer on the Internet from recording copies of all the messages passing through it?**
  - It is the data, which we receive should be notified to the user and therefore it is important the data is decrypted.

## Opgave 5.1 - Spørgsmål & Øvelser

1. **Summarize the distinctions between a process, an algorithm, and a program.**
  - A Program is representation of an algorithm.
  - A Process is the activity of the algorithm.
  - An Algorithm describes how we are going to solve a problem.
2. **Give some examples of algorithms with which you are familiar. Are they really algorithms in the precise sense?**
  - I know algorithms such as the linear function:  $f(x)=a \cdot x+b$ . It describes how we need to find a y-value through a x.
3. **Identify some points of vagueness in our informal definition of an algorithm introduced in Section 0.1 of the introductory chapter.**



- According to the answer list, it is saying that the steps be ordered and unambiguous. It is merely hints at the requirements that the steps be executable and lead to an end.
- 4. **In what sense do the steps described by the following list of instructions fail to constitute an algorithm?**
- If an algorithm is precise and just continues to execute a program with precise details, then there is a possibility that; that is not an algorithm.

Step 1: Take a coin out of your pocket and put it on the table.

Step 2: Return to Step 1.

## Opgave 5.2 - Spørgsmål & Øvelser

1. **A Primitive in one context might turn out to be a composite of primitives in another. For instance, our while statement is a primitive in our pseudocode, yet it is ultimately implemented as a composite of machine-language instructions. Give two examples of this phenomenon in a non-computer setting.**
  - A primitive is mostly known as a datatype, but in other cases the word “Primitive” has also been related to atoms. In this case it has in one level been considered as molecules which are made up from atoms.
2. **In what sense is the construction of functions the construction of primitives?**
  - If a function is constructed in a rightful manner, then the function can be used for bigger coding blocks.
3. **The Euclidean algorithm finds the greatest common divisor of two positive integers X and Y by the following process:**
  - a. **As long as the value of neither X nor Y is zero, assign the larger the remainder of dividing the larger by the smaller. The greatest common divisor, if it exists, will be the remaining non-zero value.**

Express this algorithm in our pseudocode.

- Remember that the pseudocode it is a mix up of the code and normal language.

```
X = den store input
Y = den lille input

while (Y! = 0)
  Remainder = Den resterende efter kvotienten af X og Y
  X = Y
  Y = Remainder
GCD = X
```

4. **Describe a collection of primitives that are used in a subject other than computer programming.**
  - In this case we can take the primitives in Red, Green and Blue, which are mostly commonly displayed in TV-screen as RGB-Colors!



## Opgave 5.3 - Spørgsmål & Øvelser

1. The following Questions are written below:

- a. Find an algorithm for solving the following problem: Given a positive integer  $n$ , find the list of positive integers whose product is the largest among all the lists of positive integers whose sum is  $n$ . For example, if  $n$  is 4, the desired list is 2,2 because  $2 \times 2$  is larger than  $1 \times 1 \times 1 \times 1$ ,  $2 \times 1 \times 1$ , and  $3 \times 1$ . If  $n$  is 5, the desired list is 2,3.

```
if (n==1 or n==2):  
    Svaret i listen skal indeholde en single værdi n.  
else:  
    Dividere n med 3. Derefter fås kvotienten q og resten r.  
    if (r == 0):  
        Svaret er listen som indeholder q.3s.  
    if (r == 1):  
        Svaret er 1s, da listen indeholder (q-1) 4s og to 2s.  
    if(r == 2):  
        Svaret er 1s er listen som indeholder q 3s og et 2s.
```

- 
- b. What is the desired list if  $n = 2001$ ?
- The answer sheet is saying that it will contain 667 trees.
- c. Explain how you got your foot in the door.
- Put values in the places of the input, and thereafter when you experiment the bubblesort concept, then you will be able to see a pattern like the dance video from Youtube.

2. The following Questions are written below:

- a. Suppose we are given a checkerboard consisting of  $2^n$  rows and  $2^n$  columns of squares, for some positive integer  $n$ , and a box of L-shaped tiles, each of which can cover exactly three squares on the board. If any single square is cut out of the board, can we cover the remaining board with tiles such that tiles do not overlap or hang off the edge of the board?
- According to the book, we need to place the first tile in the center so that it can be avoid the quadrant containing the hole while covering one square from each of the other quadrants. Each quadrant then represents a smaller version of the original problem.
- b. Explain how your solution to (a) can be used to show that  $2^{2n}-1$  is divisible by 3 for all positive integers  $n$ .
- In this case we can see that the board with a single hole contains  $2^{2n} - 1$  squares, and each tile covers exactly three squares.
- c. How are (a) and (b) related to Polya's phases of problem solving?
- Parts (a) and (b) are an example of the fourth phase of Polya's Problem solving phases. In this case we can see that page number 273 says: Evaluate the program for accuracy and for its potential as a tool for solving other problems.
3. Decode the following message, then explain how you got your foot in the door. Pdeo eo pda yknnayp wjosan.
- From Google Search, it says that this means: "This is the right answer".
4. Would you be following a top-down methodology if you attempted to solve a picture puzzle merely by pouring the pieces out on a table and trying to piece them together? Would your answer change if your looked at the puzzle box to see what the entire picture was supposed to look like?

- X

## Opgave 5.4 - Spørgsmål & Øvelser

1. Modify the sequential search function in Figure 5.6 to allow for lists that are not sorted.
  - We need to change the while statement, so that our target value is not equal to current entry and there remains entries to be considered.
2. Convert the pseudocode routine to an equivalent routine using a repeat statement.

```

Z = 0
X = 1
repeat:
    Z = Z + X
    X = X + 1
until (X == 6)

```

3. Some of the popular programming languages today use the syntax while (...) do (...) to represent a pretest loop and the syntax do (...) while (...) to represent a posttest loop. Although elegant in design, what problems could result from such similarities.
  - According to the book, it has been seen that the whenever there is a gap between the while and do statements, then it is always better to use different keywords to represent pretest and posttest loop structures.
4. Suppose the insertion sort as presented in Figure 5.11 was applied to the list Gene, Cheryl, Alice and Brenda. Describe organization of the list at the end of each execution of the body of the outer while structure.
5. Why would we not want to change the phrase “greater than” in the while statement in Figure 5.11 to “greater than or equal to”?
  - It is a waste of time to insist on placing the pivot above an identical entry in the list. For instance, make the proposed change and then try the new program on a list in which all entries are the same.

6. Long Question!

```

def sort(List)
    N = 1
    while (N er mindre end længden af listen):
        J = N + 1
        while (J er ikke større end længden af listen):
            if (Hvis entréen i positionen J er mindre end entréen i position N):
                J = J + 1
            N = N + 1

```

- 7.

Question!

Long

```

def sort(List)
    N = længden af listen
    while (N er større end 1):
        J = længden af listen
        while (J er større end 1):
            if (Entréen i positionen J er mindre end entréen i positionen J-1):
                Der er en forveksling mellem de to entréer.
                J = J - 1
        N = N - 1

```

## Opgave 5.5 - Spørgsmål & Øvelser

1. What names are interrogated by the binary search (Figure 5.14) when searching for the name Joe in the list Alice, Brenda, Carol, Duane, Evelyn, Fred, George, Henry, Irene, Joe, Karl, Larry, Mary, Nancy, and Oliver?
  - Remember that Binary search is where you begin the middle and roll upwards or downwards according to the position you have been asked to find.
  - Whereas Sequential Search is where you start from the beginning, and iterate through the list, until you find the spot you need to land on.
  - In this case we can see that the task refers to page number 292 and 293, where we are referred to figure 5.12 and 5.14. In this case we can see, that the first name in the list would be Harry and thereafter the name Larry would come. In the end, we would get Joe.
2. What is the maximum number of entries that must be interrogated when applying the binary search to a list of 200 entries? What about a list of 100,000 entries?
  - The answer sheet says 8 and 17.
3. What sequence of numbers would be printed by the following recursive function if we started it with N assigned the value 1?
  - In this we are getting a FIFO-Order (First in, and first out - Order). In this case we can see that when we start with 1, 2, 3, then we would get a back or a output result on 3, 2 and 1.
4. What is the termination condition in the recursive function of Question/Exercise 3?
  - According to the answer sheet, it is said that the termination condition is when N-value is bigger than or equal to 3, or simply as book also says it. If N is not less than 3. This is the condition where under which no additional activations are created.