# EKSAMEN / EXAM  TTM4100   30 05 2008

◧ **LES REGLENE FØR DU STARTER!**
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## 1.1

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1.1 | ⊠ | ☐ | 1.1.2 | ☐ | ⊠ | 1.1.3 | ☐ | ⊠ | 1.1.4 | ☐ | ⊠ | 1.1.5 | ⊠ | ☐ |
| 1.1.6 | ⊠ | ☐ | 1.1.7 | ☐ | ⊠ | 1.1.8 | ☐ | ⊠ | 1.1.9 | ☐ | ⊠ | 1.1.10 | ☐ | ⊠ |

## 1.2

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.2.1 | ☐ | ⊠ | 1.2.2 | ⊠ | ☐ | 1.2.3 | ☐ | ⊠ | 1.2.4 | ⊠ | ☐ | 1.2.5 | ⊠ | ☐ |
| 1.2.6 | ⊠ | ☐ | 1.2.7 | ☐ | ⊠ | 1.2.8 | ⊠ | ☐ | 1.2.9 | ☐ | ⊠ | 1.2.10 | ⊠ | ☐ |

## 1.3

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.3.1 | ⊠ | ☐ | 1.3.2 | ☐ | ⊠ | 1.3.3 | ☐ | ⊠ | 1.3.4 | ⊠ | ☐ | 1.3.5 | ☐ | ⊠ |
| 1.3.6 | ☐ | ⊠ | 1.3.7 | ⊠ | ☐ | 1.3.8 | ⊠ | ☐ | 1.3.9 | ⊠ | ☐ | 1.3.10 | ⊠ | ☐ |

## 1.4

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.4.1 | ☐ | ⊠ | 1.4.2 | ☐ | ⊠ | 1.4.3 | ☐ | ⊠ | 1.4.4 | ⊠ | ☐ | 1.4.5 | ⊠ | ☐ |
| 1.4.6 | ☐ | ⊠ | 1.4.7 | ⊠ | ☐ | 1.4.8 | ☐ | ⊠ | 1.4.9 | ⊠ | ☐ | 1.4.10 | ☐ | ⊠ |

## 1.5

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.5.1 | ☐ | ⊠ | 1.5.2 | ⊠ | ☐ | 1.5.3 | ☐ | ⊠ | 1.5.4 | ☐ | ⊠ | 1.5.5 | ⊠ | ☐ |
| 1.5.6 | ⊠ | ☐ | 1.5.7 | ⊠ | ☐ | 1.5.8 | ☐ | ⊠ | 1.5.9 | ⊠ | ☐ | 1.5.10 | ⊠ | ☐ |

## 1.6

| | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False | | Riktig True | Galt False |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.6.1 | ⊠ | ☐ | 1.6.2 | ⊠ | ☐ | 1.6.3 | ⊠ | ☐ | 1.6.4 | ☐ | ⊠ | 1.6.5 | ⊠ | ☐ |
| 1.6.6 | ☐ | ⊠ | 1.6.7 | ☐ | ⊠ | 1.6.8 | ⊠ | ☐ | 1.6.9 | ☐ | ⊠ | 1.6.10 | ☐ | ⊠ |

| Kontroller: | Eksamensvaktens signature / Invigilator's signature |
|---|---|
| • Studentnr. på alle sider<br>• Samme studentnr. over alt | |

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2.

This is a discussion question. Points will be given to reasonable discussions.

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3.

The application layer contains the real user programs (i.e. supporting man-machine interfaces). It depends on services offered by the underlying layers and the application layer itself. It uses application-to-application protocols.

Transport Layer enhances the network service to an appropriate **end-to-end service**. Important functions of Transport Layer include flow control, error control, addressing, etc.

Network Layer is concerned with getting user data from the source to the destination. **Routing** is the most important function. Other functions include addressing, congestion control, etc.

Link Layer's main function is to **enhance a physical channel** with a raw stream of bits to a (hopefully) error-free, flow-controlled, frame-oriented information channel. Detailed functions include framing, error control, flow control, etc. Medium access control is also done in this layer.

The main function of Physical Layer is to provide the transfer of logical bits between link layer entities.

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4.

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**4.1**

| Prefix Match | Link Interface |
|---|---|
| 11100000 | 0 |
| 11100001 00000000 | 1 |
| 11100001 | 2 |
| otherwise | 3 |

*Note: The following answer is also acceptable.*

| Prefix Match | Link Interface |
|---|---|
| 224.0.0.0/8 | 0 |
| 225.0.0.0/16 | 1 |
| 225.0.0.0/8 | 2 |
| otherwise | 3 |

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4.2

For Subnet 1, two practical options are: 223.1.17.0/25 or 223.1.17.128/25.

If Subnet 1 takes 223.1.17.0/25, Subnets 2 and 3 can take 223.1.17.128/26 and 223.1.17.192/26.

If Subnet 2 takes 223.1.17.128/25, Subnets 2 and 3 can take 223.1.17.0/26 and 223.1.17.64/26.

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5.

5.1 In the second segment from Host A to B, the sequence number is 289, source port number is 502 and destination port number is 80.

5.2 If the first segment arrives before the second, in the acknowledgement of the first arriving segment, the acknowledgement number is 289, the source port number is 80 and the destination port number is 502.

5.3 If the second segment arrives before the first segment, in the acknowledgement of the first arriving segment, the acknowledgement number is 249, indicating that it is still waiting for bytes 249 and onwards.

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6.

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6.1
The length of a polling round is

$$N(Q/R + d).$$

The number of bits transmitted in a polling round is $NQ$. The maximum throughput therefore is

$$\frac{NQ}{N(Q/R + d)} = \frac{R}{1 + \dfrac{dR}{Q}}$$

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6.2

The probablity that a given slot is a successful transmission slot is the probablity that one of the nodes transmits and that the remaining $N-1$ nodes do not transmit.

The probablity that a given node transmits is $p$; the probability that the remaing nodes do not transmit is $(1-p)^{N-1}$. Therefore the probablity a given node has a success is $p(1-p)^{N-1}$.

Since there are $N$ nodes, the probability that an aribitrary node has a success is: $N p(1-p)^{N-1}$. Thus, when there are N active nodes, the efficiency of the broadcast channel under slotted ALOHA is $N p(1-p)^{N-1}$. [Accordingly, the effective transmission rate of the channel is $RNp(1-p)^{N-1}$.]

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KOMMENTARER                                                    COMMENTS

Adjustment has been made in the final grading, corresponding to Questions Q.1.2.8, Q.1.3.4 and Q.1.6.7 as explained below:

Q.1.2.8: The Norwegian version is inconsistent with the English version.

Q.1.3.4 The question may be a bit ambiguous.

Q.1.6.7 The answer may be not obvious from the textbook.