1a What did Nyquist show?   *5pt*

1b Why do we often need modulation techniques?   *5pt*

1c What is the role of a splitter in ADSL?   *5pt*

2a Suppose you use the bit string 10101010 as frame delimiter. Show how bit stuffing works by means
of an example.   *5pt*

2b Consider the following received bit string while using the Hamming 1-bit correcting code. What was
the originally transmitted bit string? Explain you answer.   *10pt*

R:	1	1	1	1	1	1	0	0	0	1	1

3a Explain the difference between 1-persistent, nonpersistent, and *p*-persistent CSMA protocols.   *5pt*

3b The contention period in CSMA/CD protocols should be larger than $2T_{prop}$ where T_{prop} is the maximal propgation time for a signal. Why?   *5pt*

3c The IEEE 802.11 protocol supports frame fragmentation. How does this help improve the reliability
of frame transmission?   *5pt*

Grading: *The final grade is calculated by accumulating the scores per question (maximum: 45 points), and adding 5 bonus points. The maximum total MT is therefore 50 points. The final exam consists of two parts. Part 1 covers the same material as the midterm. Let $P1$ be the number of points for part 1, and $P2$ the number of points for part 2 (each being at most 50 points). The final grade E is computed as $E = \max\{MT, P1\} + P2$. The midterm exam counts only for first full exam.*