ETH
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Distributed Computing

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Computer Engineering II

Solution to Exercise Sheet 10

Basic

1 MAC Addresses vs. IP Addresses

a)
- They operate on different layers in the network stack: link layer vs network layer.
- Different size (6 bytes vs 4 or 16 bytes) and notation
- Assigned by hardware manufacturer vs by network administrator
- Used for routing vs used as unique identifier (esp. before an IP address is assigned)

b) MAC addresses are impractical for routing on the Internet as they are not grouped by network or location. (Instead they are grouped by manufacturer.)

c) Some kind of unique name is required to be able to execute any meaningful protocol when first joining a network.

2 Escape Sequences

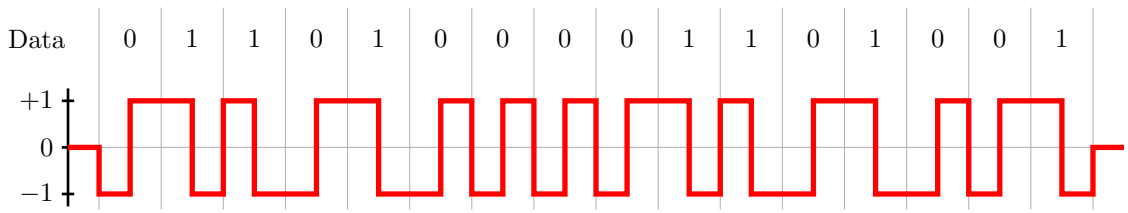
a) It is never possible to be sure a string was escaped, but some escaping schemes allow telling when a string has not been escaped, namely if it contains invalid byte sequences, i.e., `Y`z where $z \notin \{$`A`, `B`$\}$.

b) In software strings are usually parsed from the start, hence joining in the middle of an ongoing transmission as in the physical layer is not a concern. This means that the delimiter `X` may occur in the string as part of an escape sequence without being mistaken as the delimiter. Of course, escape sequences may still not start with an `X`.

c) `\"Oh no,\" Jon said, \"my cat \\\"Garfield\\\" is locked outside in the rain!\"`

3 Manchester Decoding

The bits are `0110100001101001` (in order).
$01101000_2 = 104 =$ `ascii('h')`, $01101001_2 = 105 =$ `ascii('i')`.
Hence, the message is `hi`.



4 Bit Stuffing

Note that we just list example solutions here.

a) We replace every occurence of the string `011110` (`S`) with `0111110` and every occurrence of `011111` with `0111111`. Now `S` cannot occur anymore while decoding is still possible.

To understand why this solution works, it may be helpful to think of it as an escaping scheme with `X` = `S`, `Y` = `011111`, `A` = `1` and `B` = `0`.

b) The problem is that the `0` at the end of `S` may combine with the start of the packet into another instance of `S`. The same thing may happen at the end of the packet with the leading `0` of `S`.

Solution: Perform the replacements as before. If the packet now starts with the string `11110`, replace that string with `00`, otherwise prepend a `10`. Similarly, if the packet ends with the string `01111`, replace that string with `00`, otherwise append a `01`. These operations are clearly also reversible. Note that merely using a single bit instead of two can cause a new instance of `S` to be created by the replacement/insertion.

Alternative solution: Just add a `0` to both ends of the packet *before* performing the replacements. Note that none of the replacements can remove this `0`.

5 AM/FM/PM Demodulation

The symbols are `0110 0111 0110 1111 0110 1111 0110 0100 0110 1010 0110 1111 0110 0010` (in order). The message reads `goodjob`.