Problem 5.18

We are given
- Audio signal bandwidth, $W = 15$ kHz
- Number of uniform quantization levels = 512 levels
- Encoding : binary

(a) The Nyquist rate is $2W = 30$ kHz.

(b) To accommodate 512 quantization levels, we require a binary code with B bits, which would have to satisfy the following requirement:
$2^B = 512$
Hence, $B = 9$. The sampling period $T_s = 1/30$ milliseconds must be divided into 9 bits. The minimum sampling rate is therefore
$30 \times 9 = 270$ kilobits/second
$= 0.27$ megabits/second