蒋诗翔 22CS | 12022102330 Computer Network HW2

1. We can use Nyquist's theorem due to the assumption is a noiseless channel: $2B\log_2 V$ bits/sec

That is: $2 \times 6M \times \log_2 8 = 36$ Mbps

2. This problem is concerned about 2 knowledge:

① signal to noise ratio: 20dB $\rightarrow$ $10\log_{10}(S/N) = 20 \Rightarrow S/N = 100$

② Use Shannon's theorem: $B\log_2(1+S/N)$ bps

$\downarrow$

$3k \times \log_2(1+100) \approx 19.974$ Kbps

Use Nyquist's theorem: $2B\log_2 V$ bps

$\downarrow$

$2 \times 3k \times \log_2 2 = 6$ Kbps

Since: 6Kbps < 19.974 Kbps, so maximum achievable date rate is 6Kbps.

3.

(a) Add $\tilde{A}, \tilde{B}, \tilde{C}$ together

(b) Suppose $(-1, +1, -3, +1, -1, -3, +1, +1)$ is $\tilde{C}$

then: $A \cdot \tilde{C} = 1$

$B \cdot \tilde{C} = -1$ $\Rightarrow$ So: A, D send bit 1

$C \cdot \tilde{C} = 0$ B sends bit = 0

$D \cdot \tilde{C} = 1$ C is silent

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4.

As for NRZ: It's maximum bit rate is 2B bps, so the minimum bandwidth is B/2 Hz

As for Manchester: Its maximum bit rate is $\frac{B}{2}$ bps, so ~ ~ is 2B Hz

5.

4B/5B encoding using NRZI which will ~~be~~ occur a signal transition when 1 occurs. The principle of 4B/5B is that no more than 3 consecutive 0s, so the worst case is 3 consecutive "0s" then a "1", which is 4 bits.