City University of Hong Kong
Department of Electronic Engineering

EE3009 Data Communications and Networking

Solution to Tutorial 8

1. The number of pixels is $600 \times 600 \times 8 \times 10 = 28.8 \times 10^6$ pixels per picture.
   With 8 bits/pixel representation, we have: $28.8 \times 10^6 \times 8 = 230.4$ Mbits per picture.

2. a) W=8 kHz and R=32 kbps.
   2W =16k samples/sec
   m=R/2W= 2 bits/sample

   SNR= $6m + 10\log_{10} 3(\frac{\sigma}{V})^2$ = (12-7.27)dB = 4.73 dB.

   b) SNR=40 dB = (6m-7.27) dB
   6m = 47.2
   m=8
   R = 8 bits/sample × (16×10^3 samples/sec) = 128 kbps.

3. Nyquist pulses can be sent over this channel at a rate of 20000 pulses per second.
   Each pulse carries $\log_2 16 = 4$ bits of information, so the bit rate is 80000 bits per second.

4.
   a) $W = 2400 \log_2(1 + 100)$ = 15979 bps.
   b) $W = 3000 \log_2(1 + 100)$ = 19974 bps.