Exercise 1.12 and 1.13

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1.12

Consider transmission over a telephone line with a bandwidth B = 3 kHz. This is an analogue channel which can be considered as perturbed by AWGN, and for which the power signal-to-noise ratio is at least 30 dB.

```
clear; clc;

B = 3000;

SNR = 30;
```

(a) What is the capacity of this channel, in the above conditions?

```
% Calculate the signal-to-noise ratio in gain (power)
SNRgain = 10 ^ (SNR/10);

% Capacity formula
C = B * log2(1+SNRgain)
```

```
C =

   2.9902e+04
```

(b) What is the required signal-to-noise ratio to transmit an M-ary signal able to carry 19,200 bps?

```
Creq = 19200;

% Calculate the reguired gain (power)
SNRgainReq = 2^(Creq/B)-1;

% Convert to dB
SNRreq = 10*log10(SNRgainReq)
```

```
SNRreq =

   19.2142
```

1.13

An analogue channel perturbed by AWGN has a bandwidth B = 25 kHz and a power signal-to-noise ratio SNR of 18 dB. What is the capacity of this channel in bits per second?

```
B = 25000;
SNR = 18;
SNRgain = 10^(SNR/10);

C = B * log2(1+SNRgain)
```

```
        C =

           1.5005e+05
```

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