Project (2)
Performance of Different Modulation types

Objective:
Compare the performance of the different modulation schemes(ASK – FSK – PSK).

Theoretical Background:
(1) ASK has many cases, but the case we are interested in here is the special case which is called OOK.
(2) PSK has many cases, but the case we are interested in here is the special case which is called PRK.
(3) FSK has many cases, but the case we are interested in here is the special case which is called orthogonal-FSK, in which the 2 transmitted bits are sent on 2 orthogonal carriers.

Procedure:
(4) Simulation parameters:
a. Number of bits/SNR=1e6 bits
b. Signal to noise ratio range=0 to 30 dB with 2 dB steps.
(5) Generate random binary data vector (you can make use of `randint` or `randi`).
(6) Modulate the signal according to the type of modulation you want, ex :
OOK : No change in the bits will be required
PRK: You will have to represent the 1 by 1 and the 0 bit by -1 (i.e you can use this formula : 2*vector_bits-1)
FSK : You will have to modulate the first bit of the bit stream on a certain carrier and the other bit on a carrier orthogonal on it and so on (it can be done by matlab as : if bit to send=0 send 1 else send i, where i:is the complex number)
(7) Apply noise to bits(or symbols in case of FSK) (Hint: you must calculate the signal power in this case because it is not unity)

```
Rx_sequence=bits+noise.
```

Or

```
Rx_sequence=awgn(bits,snr,'measured')
```

(8) Decide whether the Rx_sequence is '1' or '0' (Hint: try to use relational operators and in dexing to make the code more efficient)
(9) Compare the original bits with the detected bits and calculate number of errors (you can make use of `xor` or `biterr`).
(10) Save the probability of error of each SNR in matrix , BER

```
BER=[BER new prob. of error]
```

(11) Plot the BER curve against SNR (use `semilogy`)

Report requirement:
(1) Well commented M-file.
(2) Softcopy report containing required figures (BER figure for all 3 types of modulation on the same figure).

(3) Which type of modulation has the best performance?Why?
(4) At which value of SNR the system is nearly without error (for each type of modulation)?
(5) Evaluate the same curves using the MATLAB built-in function `modem.pskmod`, `modem.pammod` ,……
(6) Evaluate the probability of error of the 16QAM modulation.