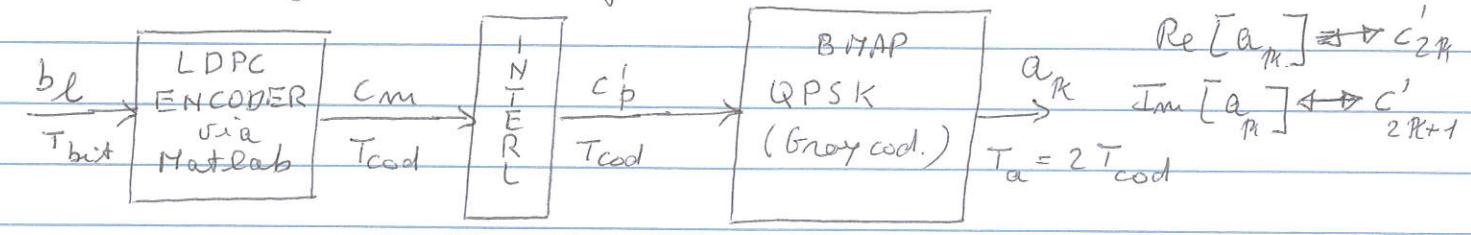
DIGITAL COMMUNICATIONS — MAY 21, 2018

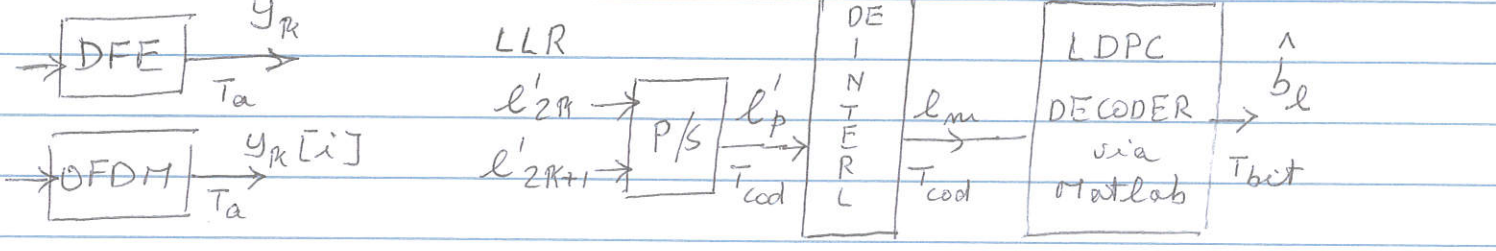
HW4 — DUE IN C_e ON MON J. 4

Symbols are generated as follows:



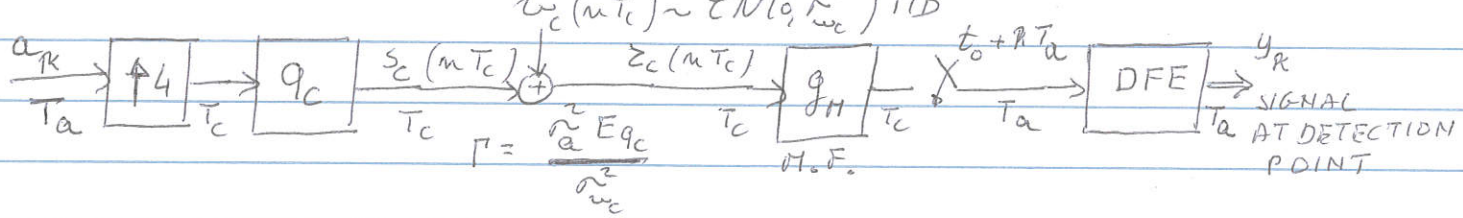
43 X 41 MATRIX
WRITE BY COLUMN
READ OUT BY ROW

RECEIVER



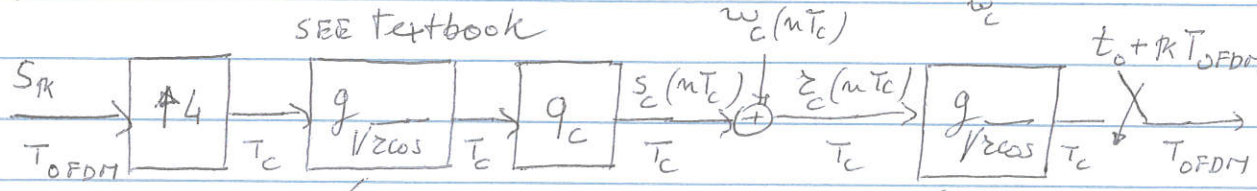
CHANNEL MODEL (SEE HW3 FOR THE EXPRESSION OF q_c)

SC (SINGLE CARRIER)



$$\Gamma = \frac{\tilde{\sigma}^2_s}{\tilde{\sigma}^2_{w_c}} E\left(g_{\sqrt{2}\cos} * q_c\right)$$

OFDM



Frequency response $\sqrt{2}\cos\left(\frac{f}{1/T_{OFDM}}, \rho\right)$, $\rho = 0.0625$

SC system. Use receiver b) of HW3 with matched filter and DFE at T. Given y_R at detection point, scale it by γ_0 to yield $\bar{y}_R$ and evaluate $Re[\bar{y}_R]$ and $Im[\bar{y}_R]$ and corresponding LLR's.

Report values of $\bar{t}_0$, σ_1, D, σ_2, and expressions of LLR's associated to c'_{2R} and c'_{2R+1} (attention to delay). Use results of HW3.

OFDM system. Let the block size $M = 512$. Moreover $T_{OFDM} = \frac{T_{block}}{M + N_{px}}$ where $T_{block} = T'$ in the textbook and N_{px} is the prefix length.

The receiver filter is a square root of a 'r cos' pulse. Its output is sampled with a suitable timing phase t_0.

Plot $\{q_c(mT_c)\}$, $\{g_{\sqrt{r\cos}}(mT_c)\}$, $\{q_R(mT_c) = g_{\sqrt{r\cos}} * q_c * g_{\sqrt{r\cos}}\}$

Plot $\{h(mT_{OFDM}) = q_R(t_0 + mT_{OFDM})\}$, equivalent ch. imp. resp. in OFDM

Plot $|Q_R(f)|$, $|G_{\sqrt{r\cos}}(f)|$, in dB, for $f \in [0, \frac{1}{2T_c}]$.

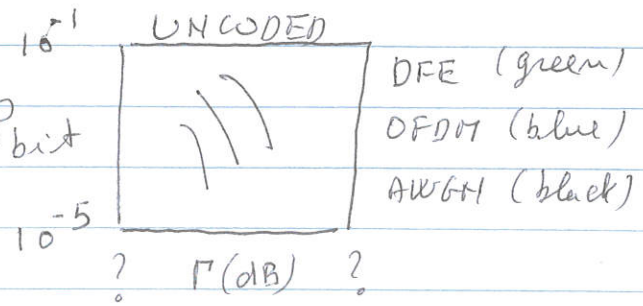
Plot the DFT of h over M samples, magnitude, in dB.

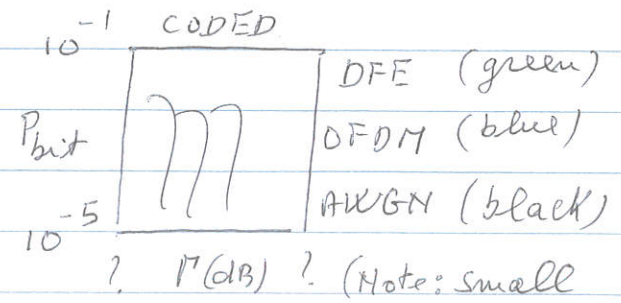
Determine t_0, the instant the receiver starts collecting $M + N_{px}$ samples, better let $t_0 = \bar{t}_0 T_c$, just report $\bar{t}_0$.

Determine suitable values for N_{px} and N_{sig} (the number of virtual subchannels).

Report expression of LLR's.

Performance Plot the following six curves





(Note: small range)