Problem 10.15. Write the defining equation for a QAM-modulated signal. Based on the discussion of QPSK and multi-level PAM, draw the block diagram for a coherent QAM receiver.
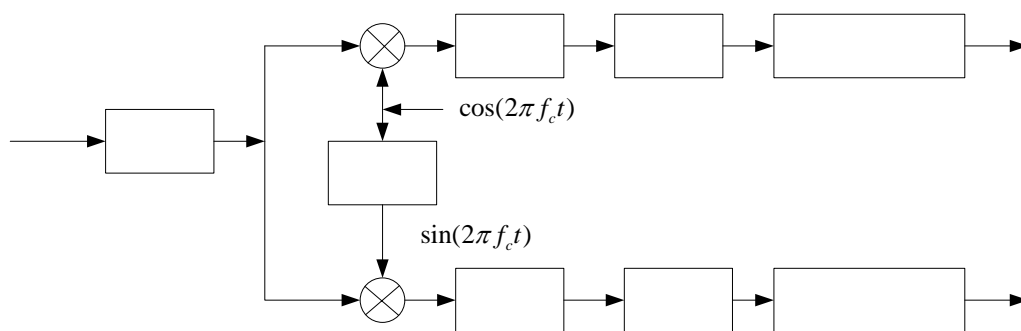
Solution

The QAM modulated signal can be defined as:

$$s(t) = \sum_k \left[b_{kI} h(t - kT) \cos(2\pi f_c t) + b_{kQ} h(t - kT) \sin(2\pi f_c t) \right],$$

where b_{kI}, b_{kQ} are different modulation levels on the *I* and *Q* channels, respectively. *T* is the QAM symbol duration, $h(t)$ is the pulse shape and is nonzero during $0 \leq t < T$, and f_c is the carrier frequency.

The block diagram for a coherent QAM receiver is

$\cos(2\pi f_c t)$

$\sin(2\pi f_c t)$

Matched
filter

Received
signal *r(t)*

x(t)

Bandpass
filter

−90°

phase shift