

## Search and Detection Receiver Operator Characteristic Curves

1. Assume a single look for a known signal in Gaussian noise. When there is no target, the received voltage signal is  $N(0, 5^2)$ . When the target is present, the received signal is  $N(s, 5^2)$ . Allow the detection threshold  $v$  to vary from  $-15$  to  $15$  dB for each ROC curve. Then plot  $(P_f(v), P_d(v))$  (i.e. the ROC curve) for each  $s=[0:2:20]$  volts.

2. Now assume:

```
s = target signal level = 10 volts;
c1 = cost of a missed detection = 10;
c2 = cost of a false alarm = 3; and
p = Prob(target present) = .3.
```

So,

```
c(v) = average_cost_per_look = p*c1*(1-Pd(v)) + (1-p)*c2*Pf(v).
```

Using MATLAB, plot  $c(v)$ , identify the minimizing  $v^*$  the associated point on the ROC curve.

3. Verify by direct differentiation that  $v^* \approx 4.1$  volts.

