IE 221
OPERATIONS RESEARCH – PROBABILISTIC MODELS
EXAM 1 FALL 1999

1 …

(a) $$EOQ = \sqrt{\frac{2KD}{ph_d}} = \sqrt{\frac{2(350)(25500)}{9(0.3)}} = 2571.2$$

(b)

$$TC = \frac{KD}{q} + \frac{qh_d p}{2} + pD = 236442 \quad \text{with} \quad q = 2571.2$$

$$TC - \frac{qh_d p}{2} = D\left[\frac{K}{q} + p\right]$$

$$D = \frac{TC - \frac{qh_d p}{2}}{\frac{K}{q} + p} = \frac{TC - \frac{2571(2.7)}{2}}{\frac{350}{2571} + 9} = \frac{TC - 3471}{9.136}$$

$$D^+ = \frac{(1.05)(236442) - 3471}{9.136} = 26794$$

$$D^- = \frac{(0.95)(236442) - 3471}{9.136} = 24206$$

(c)

$$p_1 = 9,\ p_2 = 13.5$$

$$Q^* = \sqrt{\frac{2KDp_2 h_d}{p_1 h_d}} + \frac{p_2 - p_1}{p_1}\left(\frac{D}{h_d}\right) = \sqrt{\frac{2(350)(25500)(13.5)(0.3)}{9(0.3)}} + \frac{13.5-9}{9}\left(\frac{25500}{0.3}\right)$$

$$= 45649$$

2 …

(a)

$$p = 100, u = 60, g = 51 \rightarrow c_u = p - u = 40, c_o = u - g = 9$$

Find smallest q* such that $F(q^*) \geq \frac{c_u}{c_o + c_u} = \frac{p-u}{p-g} = \frac{40}{49} = 0.816$

K	300	400	500	600	700	800
F(K)	0.1	0.2	0.6	0.8	0.9	1.0

q*=700

(b)

Expected revenue
= [(0.1)(300) + (0.1)(400) + (0.4)(500) + (0.2)(600) + (0.2)(700)].(100)
= 53000

Expected salvage
= [(0.1)(400) + (0.1)(300) + (0.4)(200) + (0.2)(100)].(51)
= 8670

Purchase cost = 700(60) = 42000

$\therefore$ Expected profit = 53000 + 8670 – 42000 = 19670

3 …

(a)

$$\mathrm{NL}(z) = \frac{R.E(D).(1-SLM_1)}{SLM_1.s_{R+L}} = \frac{(4)(550)(0.01)}{(0.99)\sqrt{(7)(300)^2}} = 0.28 \rightarrow z = 1.52$$

SS = $zs_{\mathrm{R+L}}$ = (1.52)(793.73) = 1206.46
S = (R+L).E(D) + SS = (7)(550) + 1206.46 = 5056.46

(b)

$$\mathrm{P}\left(\frac{r-E(D).L}{\sqrt{L}s_D}\right) = \mathrm{P}(4.52) \approx 1 \quad (= \mathrm{P}\{\text{sufficie nt inventory in cycle}\})$$

$\therefore$ P{insuffic ient inventory in cycle} $\approx 0 = \mathrm{SLM}_1$

$$NL(4.52) < 7(10)^{-6} = \frac{q(1-SLM_1)}{\sqrt{3}(300)} = \frac{q}{520SLM_1}$$

$\therefore q < 0.00364$

If q=1, smallest order quantity, policy is to order a replacement whenever a demand occurs.