Mini-Homework 1 Key

Parameters

$\lambda = 20$ cars / day $= 20 \times 365 = 7300$ cars / year

$c = 1300$ TL / engine

$h = I.c = 20\% \times 1300 = 260$ TL / engine-year

$K = 12{,}000$

$\tau = 20$ days $= \frac{20}{365}$ years $= 0.0547$ years

(a) $Q^* = \sqrt{\frac{2\lambda K}{h}} = \sqrt{\frac{2 \times 7300 \times 12{,}000}{260}} = 820.88$ engine

(b) Holding cost: $\frac{hQ^*}{2} = \frac{260 \times Q^*}{2} = 106714.57$ TL / year

Setup cost: $\frac{K\lambda}{Q^*} = \frac{12000 \times 7300}{820.88} = 106714.57$ TL / year

(c) $T = \frac{Q^*}{\lambda} = \frac{820.83}{7300} = 0.11245$ years

(d) $\tau < T$, so reorder point is calculated as $R = \lambda \tau = 7300 \times \frac{20}{365} = 400$ engines

(e) An order is placed 20 days before the inventory reaches to zero, or when there are 400 engines in the inventory. Hence, an order is placed

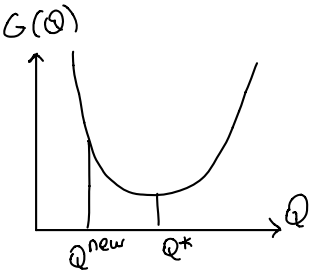
$$\frac{1200 - 400}{20} = \frac{800}{20} = 40$$

days later.

(f) (i) Since the objective function $G(Q)$ is convex in Q, we order a full container having the capacity of

$$Q^{new} = Q^* \times 75\% = 820.88 \times 75\% = 615.66 \text{ engines.}$$

where Q^{new} denotes the new order quantity.



(ii) We will calculate the objective function when Q^{new} engines are ordered at each cycle, which is equivalent to

$$G(Q^{new}) = \frac{K\lambda}{Q^{new}} + \frac{h \cdot Q^{new}}{2}$$

$$= \frac{12000 \times 7300}{615.66} + \frac{260 \times 615.66}{2}$$

$$= 222\,322.12 \text{ TL / year}$$

Therefore, the increase in total annual cost is

$$222\,322.12 - 213419.14 = 8892.98 \text{ TL / year}$$

Note: We excluded $c\lambda$ from calculations since it does not affect the increase amount in total annual cost.