Homework #8

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Question 1

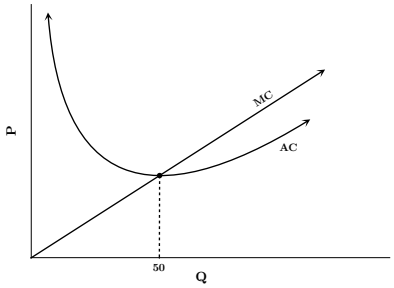
(a)

$$MC_1 = .2Q_1 \tag{1}$$

$$AC_1 = .1Q_1 + \frac{250}{Q_1} \tag{2}$$

$$MC_1 = AC_1 \Rightarrow Q_1^* = 50 \tag{3}$$

$$Q_{S_1} = 5P \tag{4}$$



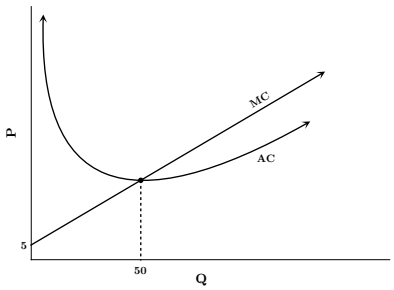
$$MC_j = .2Q_j + 5 \tag{1}$$

$$AC_j = .1 * Q_j + 5 + \frac{250}{Q_j} \tag{2}$$

$$MC_j = AC_j \Rightarrow Q_j = 50 \tag{3}$$

$$Q_j = 5P - 25 \tag{4}$$

$$\tag{5}$$



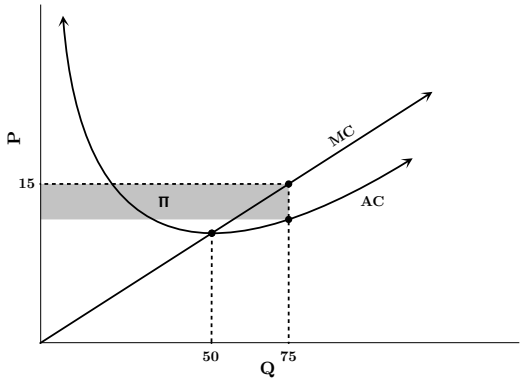
(b)

$$Q_s = 5P + 5P - 25 + 5p - 25 = 15P - 50 \tag{1}$$
$$Q_s = 15P - 50 = Q_d = 550 - 15P \tag{2}$$
$$P = 20 \tag{3}$$
$$Q_1 = 5 * 20 = 100 \tag{4}$$
$$Q_j = 5 * 20 - 25 = 75 \tag{5}$$
$$\tag{6}$$

All of these firms are earning profits in the short run as they are selling at a price of \$20, which is above the price of their optimal size.

(c)

$$P_{LR} = 15$$
$$Q_s = 15 * (15) - 50 = 175$$
$$Q_1 = 5 * 15 = 75$$
$$\pi_1 = 75 * 15 - .1 * 75^2 - 250 = 312.5$$
$$\pi_j = 0$$



Question 2

(a)

The market clearing price is \$6. $TS = 8 + 6 + 4 + 2 = 20$.

(b)

Howard (highest cost) is matched with Alice (highest reservation price), Glenn (second-highest cost) is matched with Blanche (second-highest reservation price) and so on. The total surplus (TS) is now 8.

(c)

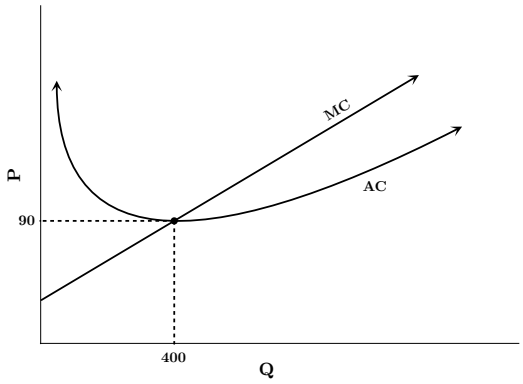
Yes. Any buyers whose reservation prices were exceeded by the market-clearing price of \$6 now have a surplus of 1 instead of 0.

Question 3

(a)

$$TC = .1Q^2 + 10Q + 16000$$
$$MC = .2Q + 10$$
$$AC = .1Q + 10 + \frac{16000}{Q}$$
$$MC = AC \Rightarrow Q^* = 400 \Rightarrow P^* = 90$$

(b)

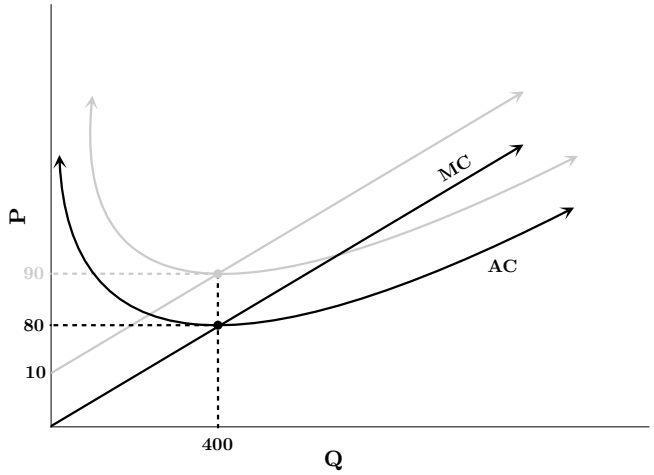


(c)

$P_{LR} = .2 * 400 + 10 = 90$.

(d)

$$MC = .2Q$$
$$AC = .1Q + \frac{16000}{Q}$$
$$MC = AC \Rightarrow Q^* = 400 \Rightarrow P^* = 80$$

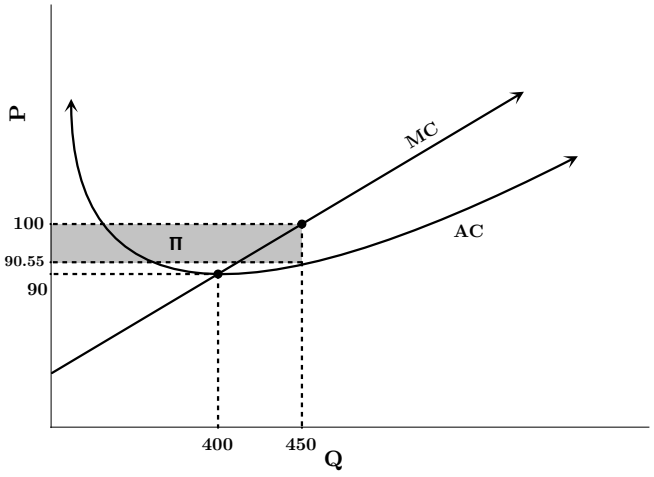


(e)

$Q = 5P = 5 * 90 = 450$

(f)

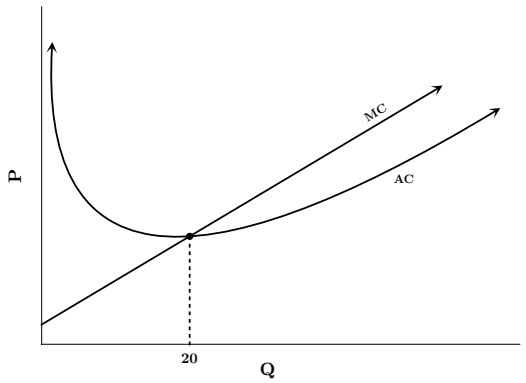
$\Pi = 450 * 90 - .1 * 450^2 - 16000 = 4250.$



Question 4

(a)

$$AC = .25Q + 1 + \frac{100}{Q}$$
$$MC = .5Q + 1$$
$$MC = AC \Rightarrow Q^* = 20$$



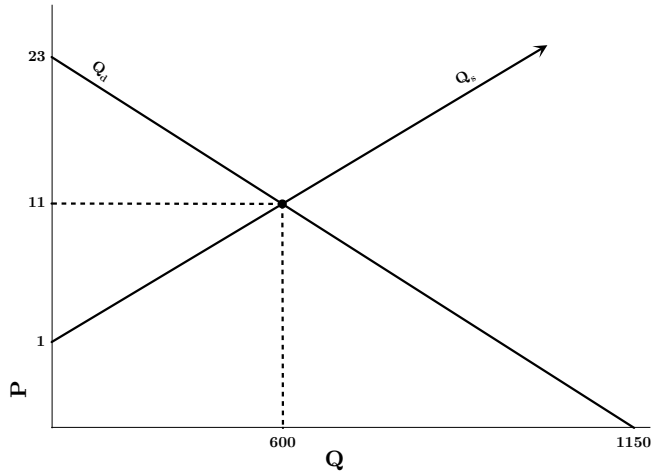
(b)

$P = .5Q + 1 \Rightarrow Q_s = 2P - 2.$

(c)

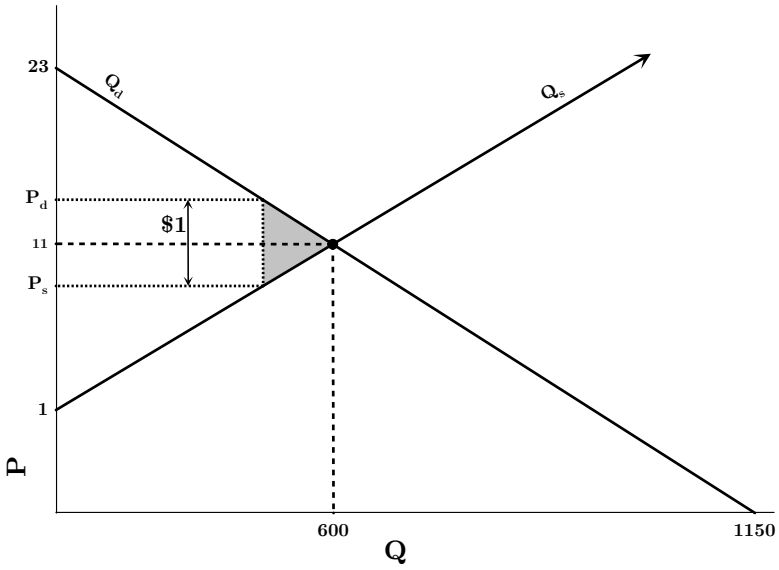
$P^* = .5 * 20 + 1 = 11$
$Q_d = 1150 - 50 * 11 = 600$
$n = \frac{600}{20} = 30$

(d)



(e)

P_d represents the price paid by consumers. P_s represents the price received by suppliers. The shaded region represents the loss in market surplus.



(f)

$dP_s = \frac{-50}{60-(-50)} = -\frac{50}{110} = -.45$
$P_d = 11.45$
$P_s = 11.45 - 1 = 10.45$

Question 5

(a)

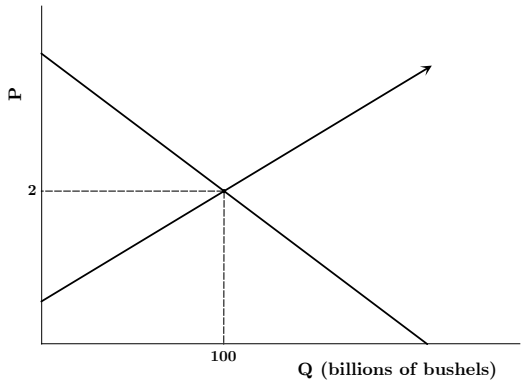
$$-.6 = \frac{-.2}{1 - \frac{p_1}{p_0}} \Rightarrow \frac{p_1}{p_0} = \frac{4}{3}$$

(b)

$$.5 = \frac{-.2}{-\frac{p_q}{p_0} + \frac{p_1}{p_0}} \Rightarrow p_q = (1.\overline{3} - .6)p_0 = \frac{11}{15}p_0$$

Question 6

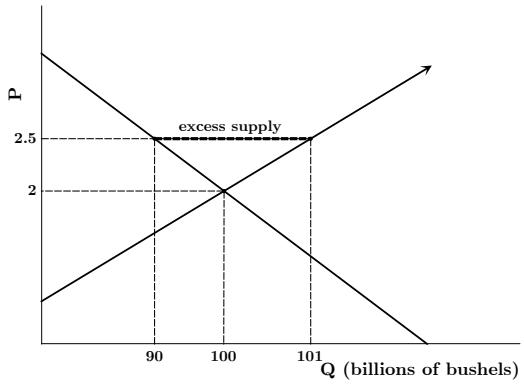
(a)



(b)

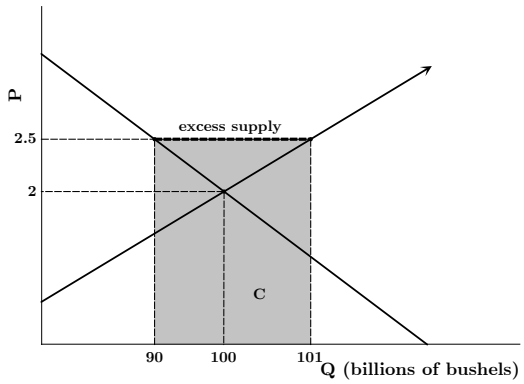
$$\frac{dQ_s}{dP} = 2 \Rightarrow dQ_s = 2 * .5 = 1 \Rightarrow Q_s = 100 + 1 = 101$$

$$\frac{dQ_D}{dP} = -20 \Rightarrow dQ_D = -20 * .5 = -10 \Rightarrow Q_D = 100 - 10 = 90$$



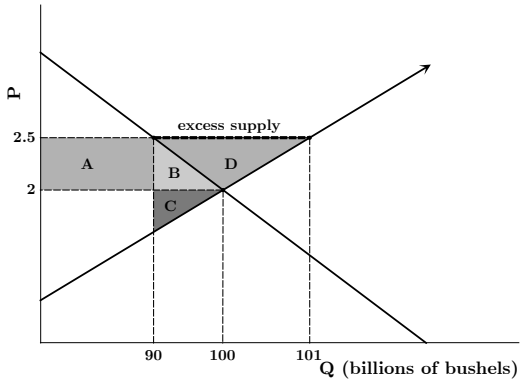
(c)

$C = (101 - 90)(2.5) = 27.5.$



(d)

$$\Delta CS = -(A+B) = -\left[(2.5-2)(90) + (2.5-2)\left(\frac{1}{2}\right)(100-90)\right] = -47.5$$
$$\Delta PS = A + B + D = (90)(.5) + (101-90)(.5) - (101-100)(.5)(.5) = 50.25$$



(e)

$A + B = .5 * 90 + .5^2 * 10 = 47.5$ comes from consumers. $D = (.5)^2(101-90) = 2.75$ comes from government.

(f)

The DWL is 2.75. It is the region D in the graph in part (d).

(g)

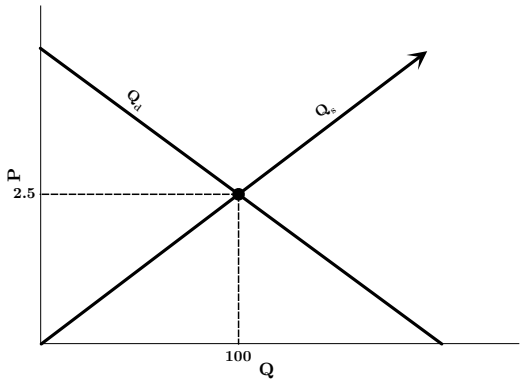
No. The changes in consumer and producer surpluses depend on their elasticities.

Question 7

(a)

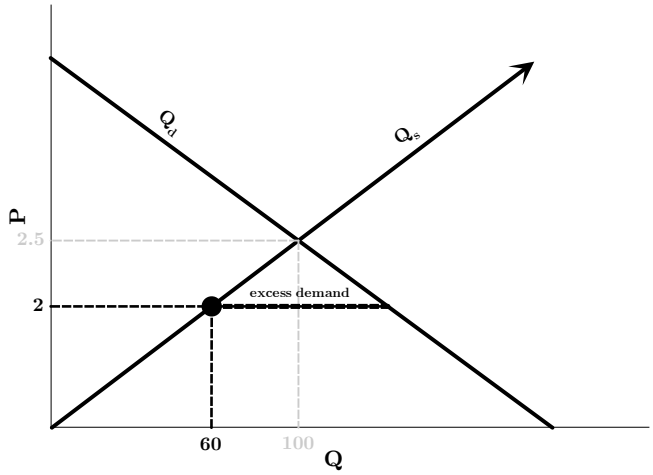
$\eta_s = -\frac{1}{2}, \eta_d = 2$.

(b)



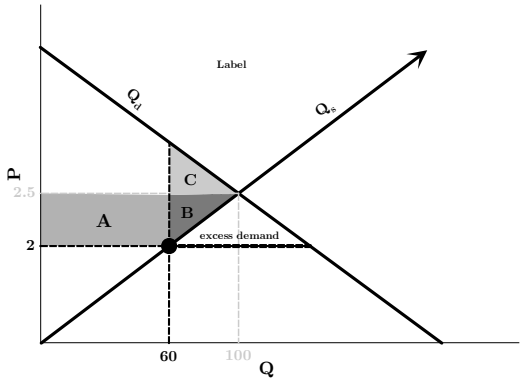
(c)

$$\frac{dQ_s}{dP} = 80 \Rightarrow dQ_s = -\frac{1}{2} * 80 = -40 \Rightarrow 100 - 40 = 60.$$



(d)

$\Delta CS = A - C; \Delta PS = -A - B.$



(e)

No. Consumer surplus varies inversely with elasticity of supply.

(f)

60. Calculations are shown in part (c).

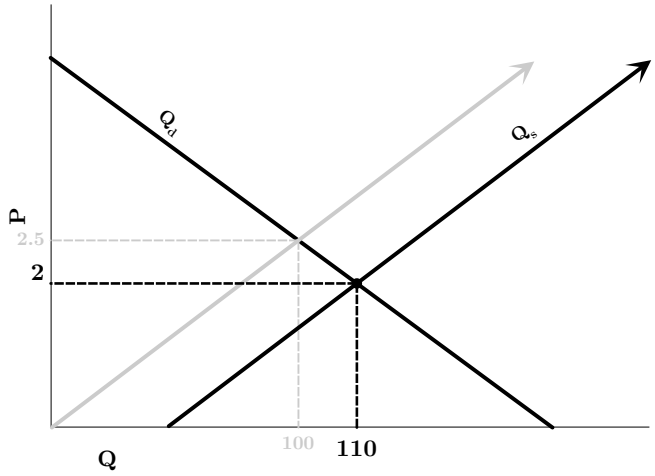
(g)

Transfer $= \frac{1}{2} * 60 = 30$. Loss $= \frac{1}{2} * 40 * 1.5 = 30$.

(h)

There was no change for consumers.

(i)



$\frac{dQ_d}{dP} = -20 \Rightarrow dQ_d = -20 * -\frac{1}{2} = 10$. Consumers are necessarily better off because shifting supply out increases quantity supplied and reduces price, guaranteeing that consumer surplus will increase.

(j)

Yes. The dead weight loss falls upon the government and is equal to the additional quantity sold times the difference between market value and the government's sale price. $DWL = 10 * .5 = 5$.

Question 8

(a)

$$1000 - 5P = 4P - 80 \tag{1}$$

$$P = 120, Q = 1000 - 5 * 120 = 400 \tag{2}$$

$$Expenditure = 120 * 400 = 48000 \tag{3}$$

$$PS = \int_{Q=0}^{Q=400} \left(100 - \frac{Q}{4}\right) dQ = 20000 \tag{4}$$

$$CS = \int_{Q=0}^{Q=400} \left(80 - \frac{Q}{5}\right) dQ = 16000 \tag{5}$$

(b)

$$\Delta TS = 36000 - \int_{Q=0}^{Q=300} \left(100 - \frac{Q}{4}\right) dQ - \int_{Q=0}^{Q=300} \left(80 - \frac{Q}{5}\right) dQ = 2250$$

(c)

$$P = 140 : CS = \frac{1}{2}(200 - 140)(300) = 9000; PS = \frac{1}{2}(95 - 20)(300) + (140 - 95)(300) = 24750$$

$$P = 95 : \frac{1}{2}(200 - 140)(300) + (140 - 95)(300) = 22500; PS = \frac{1}{2}(95 - 20)(300) = 11250$$

(d)

For $Q = 450$:

$$P_D = 200 - \frac{450}{5} = 110$$

$$P_s = 20 + \frac{450}{4} = 132.5$$

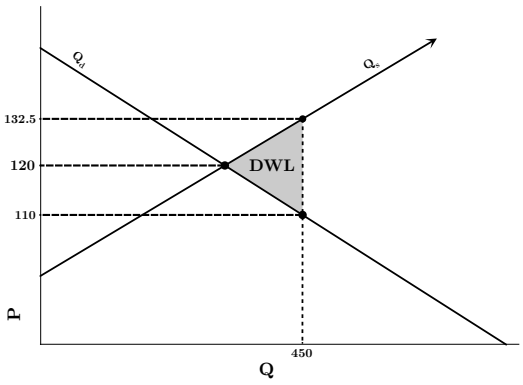
Choosing to keep $P = 120$:

$$CS = \frac{1}{2}(200 - 110)(450) + 450 * 110 - (450 * 120) = 15750; \Delta CS = 250.$$

$$PS = 450 * 120 - \frac{1}{2}(132.5 - 20)(450) - 450 * 20 = 19687.5; \Delta PS = 312.5.$$

$$\Delta TS = 562.5.$$

Modifying the price within the 110 to 132.5 range only changes the consumer and producer share of loss, not the total loss.


Q_d
Q_s
132.5
120
110
DWL
P
450
Q