HW2

Li Haolun 2022011545

November 5, 2023

1. (a)

$$\begin{aligned} k(x_1, x_2) &= -\frac{\frac{\partial U}{\partial x_1}}{\frac{\partial U}{\partial x_2}} \\ &= -\frac{3x_1^2 x_2^5}{5x_1^3 x_2^4} \\ &= -\frac{3x_2}{5x_1} \end{aligned}$$

   (b) We have $\frac{3x_2}{5x_1} = \frac{p_1}{p_2}$, which is eqivalent to $5p_1x_1 = 3p_2x_2$. So the expenditure share of goods 1 is $\frac{3}{3+5} = \frac{3}{8}$.

   (c)

$$\begin{aligned} k(x_1, x_2) &= -\frac{\frac{\partial U}{\partial x_1}}{\frac{\partial U}{\partial x_2}} \\ &= -\frac{ax_2}{bx_1} \\ &= -\frac{p_1}{p_2} \end{aligned}$$

   $\Rightarrow bp_1x_1 = ap_2x_2$, so the expenditure share of goods 1 is $\frac{a}{a+b}$.

2. (a)

$$\begin{aligned} k(x_1, x_2) &= -\frac{\frac{\partial U}{\partial x_1}}{\frac{\partial U}{\partial x_2}} \\ &= \frac{1}{100 - 2x_2} \\ &= -\frac{p_1}{p_2} \\ &= -\frac{1}{4} \end{aligned}$$

   $\Rightarrow 4 = 100 - 2x_2$
   $\Rightarrow x_1^* = 308$, $x_2^* = 48$.

   (b) We still have $4 = 100 - 2x_2$, so $x_1^* = 808$, $x_2^* = 48$.

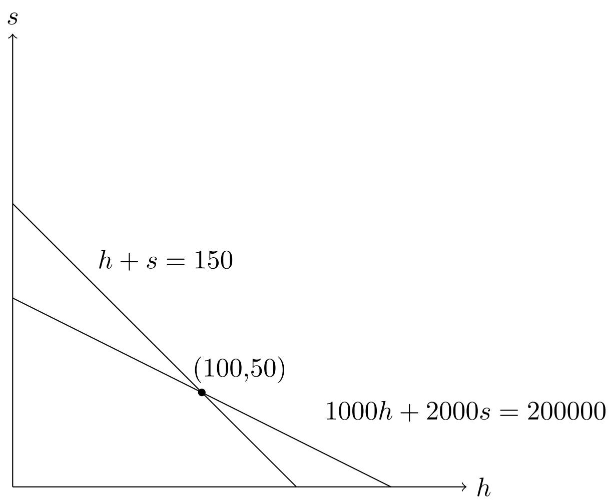
   (c) From the utility function, we always have $4 = 100 - 2x_2$, which means that x_2 is always 48 .
   So, if the consumer consumes both goods, her income a must be larger than $48 \times 4 = 192$.

3. (a) $q = 0.02 \times 7500 - 3 \times 30 = 60$.

   (b) Before the price of a blind box rose, Li Hua spent 5700 Yuan on all other goods. So, Li Hua need $5700 + 60 \times 40 = 8100$ Yuan after the price rose.
   And he would buy $q^{'} = 0.02 \times 8100 - 3 \times 40 = 42$ boxes at this income.

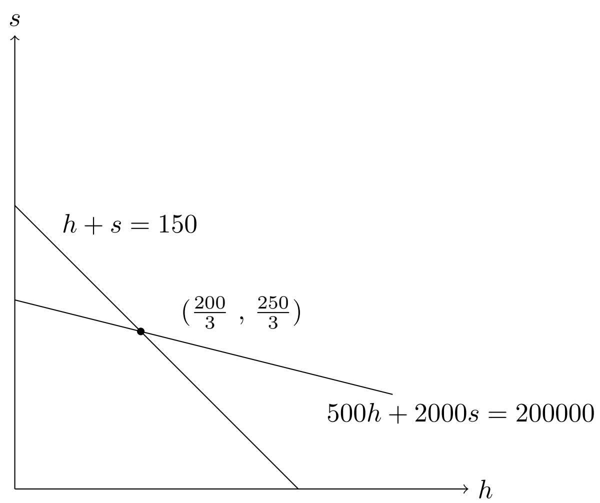
   (c) $q^{''} = 0.02 \times 7500 - 3 \times 40 = 30$.

   (d) Substitution effect: $q^{'} - q = -18$.
   Income effect: $q^{''} - q^{'} = -12$.



4. (a)
   $1000h + 2000s = 200000$ means the hotel manager's budget constraint.
   $h + s = 150$ means the hotel manager's reality constraint.
   So, he will buy 100 hard mattresses.

   (b)



   Now he will buy $\frac{200}{3}$ hard mattresses and $\frac{250}{3}$ soft mattresses.
   Hard mattress is Giffen good for him.

5. (a)

$$k(c,r) = -\frac{\frac{\partial U}{\partial r}}{\frac{\partial U}{\partial c}} = -\frac{c}{r}$$

   For Magneto, her budget constraint is $c + 50r = 4000$.
   So we have $\frac{c}{r} = 50$. And the solution is $c = 2000$, $r = 40$.

   (b)

$$\begin{cases} c + 40r = 3200 & r \geq 40 \\ c + 60r = 4000 & r < 40 \end{cases}$$

   (c) No, he won't.
   When $r \geq 40$, we have $\frac{c}{r} = 40$, then $r = 40$.

When $r < 40$, we have $\frac{c}{r} = 60$, then $r = \frac{100}{3}$.
The best choice for Xavier is $c = 2000$, $r = \frac{100}{3}$.

(d) Magneto has the better job, because $U_M = 2000 \times \frac{100}{3} > U_X = 1600 \times 40$.

6. (a) He will choose 10 hours for leisure.

(b) His budget constraint is $C + 10R = 190$.

$$\begin{aligned} k(C,R) &= -\frac{\frac{\partial U}{\partial R}}{\frac{\partial U}{\partial C}} \\ &= 2R - 20 \\ &= -10 \end{aligned}$$

So we have $R = 5$, $C = 140$. He will choose to work 11 hours.

(c) Now his budget constraint is $C + 8R = 190 \times 0.8 = 152$.
We still have $R = 6$, then $C = 104$. He will choose to work 10 hours.

7. (a) $m_1 + \frac{m_2}{1+r} = c_1 + \frac{c_2}{1+r}$.

(b) He can consume $m_1(1+r) + m_2$, which is the future value of his endowment.

(c) He can consume $m_1 + \frac{m_2}{(1+r)}$, which is the present value of his endowment.

(d) Slope is $-(1+r)$.

8. (a) In this question, $m_1 = 1000$, $m_2 = 150$, $r = -0.25$.
So villagers' budget constraint in present value terms is $1200 = c_1 + \frac{4}{3}c_2$.

$$\begin{aligned} k(c_1,c_2) &= -\frac{\frac{\partial U}{\partial c_1}}{\frac{\partial U}{\partial c_2}} \\ &= -\frac{c_2}{c_1} \\ &= -(1+r) = -0.75 \end{aligned}$$

$\Rightarrow c_1 = 600$, $c_2 = 450$.

(b) Since the villagers can sell and buy wheat in any year, and the price is \$1 per kilo, so villagers' money can be seen as wheat, and they don't have to suffer from the loss during storage.
So villagers' budget constraint in present value terms is $1000 + 150/(1+0.1) = \frac{12500}{11} = c_1 + \frac{c_2}{1.1}$.
We have $\frac{c_2}{c_1} = 1.1$, then $c_2 = 625$
Now, the villagers will consume $c_1 = \frac{6250}{11}$, $c_2 = 625$.

9. (a) $P(m) = 20 = 40 - 2m \Rightarrow m = 10$. His consumer's surplus is $\frac{20\times10}{2} = 100$.

(b) Now he will consume 15 cups per month, and his consumer's surplus is $\frac{30\times15}{2} = 225$.
So Mr. Hacker's change in consumer's surplus is $+125$.

10. (a) Oliver has quasilinear utility function. His inverse demand function is $P(x) = 60 - x$.

(b) He will consume 30 bottles of wine.

(c) 10 .

(d) In (b), his consumer's surplus is $\frac{30\times30}{2} = 450$.
In (c), his consumer's surplus is $\frac{10\times10}{2} = 50$.
So, the change in consumer's surplus is -400 .