Midterm 1

Multiple Choice Questions (18 points):

1. c: d: $E_p = \frac{\%\Delta Q}{\%\Delta P} = \frac{(71-70)/70*100}{10}$ = 1/7
2. a: Higher interest rate increases opportunity cost of capital
3. a: Cost efficiency analysis
4. c: $P = 10 - 2.6 * Q$, $Q = \frac{10}{2.6} - \frac{1}{2.6}P$; $\frac{10}{2.6} - \frac{1}{2.6} * 5 = 1.923\,1$

$$P^* = 4 \rightarrow Q^* = \frac{10}{2.6} - \frac{1}{2.6} * 4 = 2.307\,7$$

$$P' = 5; Q' = \frac{10}{2.6} - \frac{1}{2.6} * 5 = 1.923\,1$$

$E_p = \frac{(1.9231-2.3077)/2.3077}{(5-4)/4} = -0.666\,64$

5. b: QALY is a Cost Utility Analysis and evaluates interventions in utility rather than dollars.
6. d: Point D is outside the budget set.

Short Answer Questions:

Demand Supply (25 points)

1. Demand Supply on Island

   (a) Draw demand supply for 2 markets: Hospital Services (supply by Hospitals, demand by patients); Private Doctor Services (supply by private doctors, demand by patients). Just draw two separate graphs for each market with demand and supply lines and mark equilibrium prices and quantities.

   (b) Volcano eruption, decreases supply for Hospital services, since Hospitals are closer to volcanoes. Patient demand is likely to increase as well due to the volcano accident. In the hospital market supply contracts (shifts left) and demand increases (shifts right). Prices will increase, quantity demanded may or may not increase, it depends on whether demand shifts by enough to increase the quantity demanded. If demand does not shift a lot, then quantities demanded could actually decrease in the new equilibrium.
   In the market for private doctor services demand shifts right due to more patients. Doctor services could be interpreted as substitutes, so that demand should shift even further to the right, in case the hospital market experiences lower quantities demanded. The prices for doctors increases and the quantity demanded for doctor services increases as well. In case you assume that some of the hospital doctors join the private doctor practices, you could also argue that supply of private doctor services shifts out.

   (c) $P = 30 - Q$ and $P = 3 + 2Q$

$$\begin{aligned} 30 - Q &= 3 + 2Q, \\ Q^* &= 9. \end{aligned}$$

The equilibrium is:

$$P^* = 21.$$

Total surplus is:

$$TS = \frac{(30-3)*9}{2} = 121.5$$

(d) New doctors coming to the island increase supply, so "vertically" supply shifts down by \$2, so that the new intercept is at $3-2 = 1\$$. New supply: $P = 1+2Q$, then Equilibrium is: $1 + 2 * 9.6667 = 20.333$

$$\begin{aligned} 30 - Q &= 1 + 2Q \\ &\rightarrow \quad Q' = \frac{29}{3} = 9.6667 \\ &\rightarrow \quad P' = 1 + 2 * 9.6667 = 20.333 \end{aligned}$$

Total Surplus is: $TS = \frac{(30-1)*9.6667}{2} = 140.17$. The increase in surplus in percent is

$$\Delta TS = \frac{140.17 - 121.5}{121.5} = 0.15366,$$

or roughly 15.4 percent.

(e)

(f) Demand Supply (32 points)

$$\begin{aligned} D &: \quad P = 12 - 2 * Q, \\ S &: \quad Q = P/2.5 - 1/25. \end{aligned}$$

Or "inverse" supply

$$P = 0.1 + 2.5 * Q.$$

Equilibrium:

$$\begin{aligned} 12 - 2 * Q &= 0.1 + 2.5 * Q \\ &\rightarrow \quad Q^* = \frac{11.9}{4.5} = 2.6444 \\ &\rightarrow \quad P^* = 6.711 \end{aligned}$$

(g) Total surplus is the sum of $CS + PS$ and CS is the difference between the market price and a consumers willingness to pay for the good. PS surplus is the difference between the market price and the value that a producer is willingness to supply the good for. Total surplus is the total benefit that market participants get from trading at market prices.

$$TS = \frac{(12-0.1)*2.6444}{2} = 15.734$$

(h) Price floor $P_{Floor} = 8$; $P = 12 - 2 * Q \rightarrow Q = 6 - \frac{1}{2}P$, so that at price floor the quantity demanded is: $Q = 6 - \frac{1}{2}8 = 2 = Q_{Floor}$. At $Q_{Floor} = 2$, the supply price would be: $P = 0.1 + 2.5 * 2 = 5.1$. Now

$$CS = \frac{(12-8)*2}{2} = 4$$

and Producer surplus is:

$$PS = \frac{(5.1-0.1)*2}{2} + (8-5.1)*2 = 10.8$$

Total surplus is 14.8. Draw graph of this and write CS and PS into the respective triangles.

2. CBA and Production Functions (25 points)

(a) Current annual output at $K = 100$, $L = 300 * 1500 = 450000$ is: $Y = 10 * 100^{0.5} * (1500 * 300)^{0.5} = 67082$ pounds of meat.

(b) The annual production value is: $GDP = 67082 * 5 = \$335\,410$

(c) With water cleaning projects workers work an extra 200 hours a year, so output at $K = 100$, $L = 300 * 1700 = 510\,000$ is:
$Y_{with\,\mathrm{Pr}\,oject} = 10 * 100^{0.5} * (1700 * 300)^{0.5} = 71414$ pounds of meat or $GDP_{with\,\mathrm{Pr}\,oject} = 71414 * 5 = \$357\,070$

(d) Extra annual output is therefore: $GDP_{with\,\mathrm{Pr}\,oject} - GDP = \$357070 - \$335410 = \$\,21\,660$

(e) Present value (in 2010 dollars) of benefits is: $\frac{21660}{1.08} + \frac{21660}{1.08^2} + \frac{21660}{1.08^2 * 1.1} + \frac{21660}{1.08^2 * 1.1^2} + \frac{21660}{1.08^2 * 1.1^3} = \$84806$ and the present value of cost is $\$70,000$.

(f) I assume that costs are incurred in year 2010 and benefits are realized over the next 5 years. The project will be implemented since $B > C$, or in other words the net present value is positive: $NPV = -70000 + \frac{21660}{1.08} + \frac{21660}{1.08^2} + \frac{21660}{1.08^2 * 1.1} + \frac{21660}{1.08^2 * 1.1^2} + \frac{21660}{1.08^2 * 1.1^3} = 14806$.