

## ANSWER KEY TO QUIZ 4: ECON 102, SECTION 1

Prepared by SERGIY STETSENKO (sestet@sas.upenn.edu)

Q1. (2 points for each property).

Preferences are represented by  $u(c, l)$

1. Complete:

$\forall (c_i, l_i), (c_j, l_j), u(c_i, l_i)$  is either  $>$ ,  $<$  or  $=$  than  $u(c_j, l_j)$

For every two consumption bundles A and B, A is preferable to B, B is preferable to A or the consumer is indifferent between A and B.

2. Convex:

$\forall (c_i, l_i), (c_j, l_j)$  if  $u(c_i, l_i) < u(c_j, l_j)$  then  $u(c_i, l_i) < \theta u(c_i, l_i) + (1 - \theta)u(c_j, l_j) \forall \theta \in (0, 1)$

If the consumer is indifferent between two consumption bundles then some mixture of these bundles is preferable to either one.

3. Transitive:

$\forall (c_i, l_i), (c_j, l_j), (c_k, l_k)$  if  $u(c_i, l_i) \geq u(c_j, l_j)$  and  $u(c_j, l_j) \geq u(c_k, l_k)$  then  $u(c_i, l_i) \geq u(c_k, l_k)$

If a consumption bundle A is preferable to B and B is preferable to C then A is preferable to C.

Q2. (2 points for a correct answer, 2 points for explanation).

True. A substitution effect measures the implications of changes of the relative prices holding total utility constant.

Q3. (2 points for each way, 2 points for the property).

1. Linear technology.
2. An externality in capital.
3. Innovation by firms. New ideas.

Common property is the linear returns on reproducible capital.

Q4. (4 points for an expression, 2 for the effect of wage changes, 2 for the effect of profits changes).

$\max_{c, l} u(c, l)$  is equivalent to  
 $s.t. c = w(1 - l) + \pi$

$\max_l \{\log(w(1 - l) + \pi) + \log(l + \theta)\}$

Assuming interior solution:

$$\text{FOC: } \frac{-w}{w(1-l)+\pi} + \frac{1}{l+\theta} = 0 \Rightarrow l(w, \theta, \pi) = \frac{\pi + w(1-\theta)}{2w}$$

$$w \uparrow \Rightarrow l \downarrow, \pi \uparrow \Rightarrow l \uparrow$$

Q5. (2 points for definition, 1 for each example).

Non-rivalrous good: the marginal cost of providing a good to one more consumer is constant at zero.

Non-excludable good: it's impossible to prevent a person from consuming a good when it becomes publicly available at a relatively low cost.

Non-rivalrous but excludable: ideas

Non-rivalrous and non-excludable: public goods, f.e. national defense.

Q6. (2 points for a correct answer, 2 points for explanation).

False. In first case there is no limit on accumulation of human capital and perpetual growth is possible. The second approach puts a limit on a rate human capital can grow and fails to generate sustainable growth.

Q7.

An increase in taxes (assume lump sum tax as in lecture notes) leads to decrease in income, leisure goes down due to income effect. Consumption also decreases. There is no change in  $w$  so substitution effect is zero.

Q8.

An increase in  $w$  implies negative substitution effect and positive income effect on leisure. The total effect on leisure is ambiguous. Substitution effect on consumption is positive, assuming that consumption is normal good, income effect on consumption is also positive, hence, consumption goes up.