UNIVERSITY COLLEGE LONDON

EXAMINATION FOR INTERNAL STUDENTS

MODULE CODE	:	**ECON3030**
ASSESSMENT PATTERN	:	**ECON3030A**
MODULE NAME	:	**Behavioural Economics**
DATE	:	**16 May 2016**
TIME	:	**10:00 am**
TIME ALLOWED	:	**2 hours**

This paper is suitable for candidates who attended classes for this module in the following academic year(s):

2015/16

TURN OVER

SUMMER TERM 2016

ECON3030: BEHAVIOURAL ECONOMICS

TIME ALLOWANCE: 2 hours

Answer All TWO questions from Part A and Answer ONE question from Part B.

Each question in Part A and Part B carries the equal proportion of the total mark.

In cases where a student answers more questions than requested by the examination rubric, the policy of the Economics Department is that the student's first set of answers up to the required number will be the ones that count (not the best answers). All remaining answers will be ignored.

PART A

Answer *all two* questions from this section.

A.1. In a modern city, individuals face the following portfolio choice problem. There are two unknown states, $i = 1, 2$, and two associated Arrow securities, x_i. The two states are equally probable, that is, each state occurs with probability $1/2$. Each individual wishes to choose the most preferable portfolio (x_1, x_2) from the budget constraint, $p_1 x_1 + p_2 x_2 \leq 1$, where p_i denotes the price of Arrow security x_i. There are two types of individuals in this city: the first type is called *HoDong* and the second one is called *NakRyang*. HoDong's preferences are represented by Expected Utility (EU) model. NakRyang's preferences are represented by Rank-Dependent Utility (RDU) model. Both types share a common utility function over monetary outcomes, $u(x) = \ln x$.

(a) Write down the utility representation of HoDong's preferences and derive the optimal portfolio choice for him.

(b) Write down the utililty representation of NakRyang's preferences. Suppose that this second type of individuals exhibit pessimism. Determine the parameter restriction of pessimism on the utility representation.

(c) Derive the optimal portfolio choice for NakRyang.

The council of the city is currently investigating the status of individuals' portfolio choice. In order to make this investigation scientific, the council hires an economist. Both the council and the economist are not aware of the existence of two different types of individuals.

(d) Suppose the economist happened to collect a set of portfolio choice data, $\left\{\left(p_1^t, p_2^t\right), \left(x_1^t, x_2^t\right)\right\}_{t=1}^T$, in which only the first type of individuals, HoDong, are present. He uses the following log-log regression specification:

$$\ln\left(\frac{x_1^t}{x_2^t}\right) = \beta_0 + \beta_1 \ln\left(\frac{p_2^t}{p_1^t}\right) + \varepsilon^t.$$

What estimates is the economist likely to get from this dataset?

(e) Suppose now that the economist happened to collect another set of portfolio choice data in which only the second type of individuals, NakRyang, are present. He again uses the same log-log specification as in (d). What estimates is the economist likely to get?

(f) Another smarter economist approaches the council and suggests to check if there is a non-linear pattern between $\ln\left(\frac{x_1}{x_2}\right)$ and $\ln\left(\frac{p_2}{p_1}\right)$ for the data used in (e). If you were this smarter economist, what specification will you suggest?

(g) Now consider three equally probable unknown states, $i = 1, 2, 3$, and three associated Arrow securities, x_i, for $i = 1, 2, 3$. Write down the utility representation of NakRyang's preferences (that is, RDU representation). Determine the parameter restriction of pessimism on the utility representation.

A.2. Consider an individual with quasi hyperbolic discounting, the (β, δ) model, who lives over three periods, $t = 1, 2, 3$. Let c_t denote consumption in period $t = 1, 2, 3$. Assume that the per-period utility function is given by the natural logarithm function

$$u(c_t) = \ln c_t.$$

There is a labour income $y > 0$ in period 1 but no income in subsequent periods. We assume for now that the individual can only save in one period financial instruments with its interest rate being normalized to be zero.

(a) Write down the lifetime discounted utilities of self 1 and self 2 and the budget constraints in each time period.

Suppose that $\beta = 1$ and $\delta \leq 1$ in (b), (c), and (d).

(b) Derive the optimal consumption/saving behaviour of self 2, given a strictly positive saving in period 1, $s_1 > 0$.

(c) Derive the optimal consumption/saving behaviour of self 1, anticipating the optimal behaviour of self 2.

(d) Suppose that the individual in period 1, self 1, can commit a consumption plan that is binding to self 2. Derive the optimal consumption/saving plan of self 1. Show if the consumption plan under perfect commitment is consistent with the consumption solutions of (b) and (c).

Suppose from now on that $\beta < 1$ and $\delta \leq 1$ and the individual is so sophisticated that self 1 has correct beliefs about the preferences of subsequent selves.

(e) Derive the optimal consumption/saving behaviour of self 2, given a strictly positive saving in period 1, $s_1 > 0$.

(f) Derive the optimal consumption/saving behaviour of self 1, anticipating the optimal behaviour of self 2.

(g) Suppose that the individual in period 1, self 1, can commit a consumption plan that is binding to self 2. Derive the optimal consumption/saving plan of self 1. Show if the consumption plan under perfect commitment is consistent with the consumption solutions of (b) and (c).

PART B

Answer ONE question from this section.

PART B

B.1. Consider Fehr and Schmidt (1999)'s model of inequity aversion with the following utility function for individual i, for the income distribution $x = (x_1, ..., x_n)$

$$U_i(x_i, x_{-i}) = x_i - \frac{\alpha_i}{n-1}\sum_{j \neq i} \max\{x_j - x_i, 0\} - \frac{\beta_i}{n-1}\sum_{j \neq i} \max\{x_i - x_j, 0\}$$

where $\alpha_i \geq \beta_i \geq 0$ and $\beta_i < 1$. In order to understand how the FS model can explain empirical patterns of the ultimatum game experiment, take standard ultimatum game with a pie of size 1. The proposer offers $(1-x, x)$ and the responder gets $0 < x < 1$ if she accepts it and nothing otherwise. Suppose that both players have complete information about the other's preferences.

(a) Does the responder accept all offers $x \geq 0.5$?

(b) Find the responder's best response given the proposer's offer $(1-x, x)$.

(c) Find the equilibrium share offered by the proposer to the responder.

B.2. Standard economic analysis assumes that individuals make decisions using all the available information. Contrary to this standard view, there is accumulating evidence that suggests that individuals are inattentive to some types of information. This alternative view can be put into perspective via a model of attention as a scarce resource and can be tested against data. One prominent example of this alternative approach is Chetty, Looney, and Kroft (2009)–"Salience and Taxation: Theory and Evidence," *American Economic Review*–who provided evidence on inattention and imperfect optimization in the case of taxation. Specifically, they compare the effect of commodity price changes with tax changes in the case of the United States where commodity prices exclude sales taxes. To motivate their empirical analysis, consider the following framework about consumer behaviour in an economy with two goods, x and y, that are supplied perfectly elastically. We normalize the price of y to one and let p denote the pretax price of x. Assume that y is untaxed and x is subject to an ad valorem sales tax τ. The total price of x is then $q = (1+\tau)p$. The price that consumers see when deciding what to purchase is p; the sales tax is not included in the posted price. Since consumers must calculate q themselves but can see p directly, the tax-inclusive price q may be less "salient" than the pretax price p.

(a) Let $x(p, \tau)$ denote demand as a function of the posted price p and the ad valorem sales tax τ. Explain the relationship between $x(p, \tau)$ and $x((1+\tau)p, 0)$ in the neoclassical full-optimization model where consumers are fully attentive.

(b) The demand function $x(p,\tau)$ can be log-linearized as follows:

$$\log x(p,\tau) = \alpha + \beta \log p + \theta_\tau \beta \log(1+\tau).$$

Define $\varepsilon_{x,p} \equiv -(\partial \log x)/(\partial \log p)$ and $\varepsilon_{x,1+\tau} \equiv -(\partial \log x)/(\partial \log(1+\tau))$ as the price elasticity of demand and the tax elasticity of demand, respectively. Interpret θ_τ in the log-linearized demand function and relate it to the boundedly rational model of attention.

(c) One empirical strategy used by Chetty et al. (2009) is to make the sales tax as salient as the pretax price by posting the tax-inclusive price q on the shelf in their field experiment in a grocery store. When tax-inclusive prices are posted, consumers presumably optimize relative to the tax-inclusive price and set demand to $x((1+\tau)p, 0)$. Compute the effect of posting the tax-inclusive price on demand relative to demand when pretax price p is only posted on the shelf, that is, $\log x((1+\tau)p, 0) - \log x(p,\tau)$. Also, derive the degree of inattention as a function of (price and tax) elasticities of demand.

B.3. Consider an urn that contains 30 red balls and 60 balls in some combination of black and white. An individual does not know the composition of black and white balls in the urn. There are securities (or acts) in the following form: (x_R, x_B, x_W) means that an individual receives x_i if a ball drawn from the urn is i-coloured. Savage (1954) provides a theory of individual decision making under subjective uncertainty, called *Subjective Expected Utility Theory*. Roughly speaking, Savage's theory says that when an individual faces subjective uncertainty, his preference over acts (or securities) can be represented by a single prior belief over uncertain states and a utility function such that for an act (x_R, x_B, x_W),

$$U((x_R, x_B, x_W)) = \sum_{i=R,B,W} p_i u(x_i).$$

(a) Ellsberg (1961) provides thought experiments in which individuals could show behaviour violating Savage's theory. For example, an individual prefers $(£100, £0, £0)$ over $(£0, £100, £0)$. And he also prefers $(£0, £100, £100)$ over $(£100, £0, £100)$. Such a pair of choices are indeed inconsistent with Savage's theory. Show why it is so.

(b) Suppose now that the individual's preference over securities is represented by the Maxmin Expected Utility (MEU) model:

$$U_{MEU}\left((x_R, x_B, x_W)\right) = \min_{(p_R, p_B, p_W) \in \Delta} \left\{ \sum_{i=R,B,W} p_i u\left(x_i\right) \right\},$$

where Δ is the set of prior beliefs that an individual has. Suppose that this set is given by

$$\Delta = \left\{ (p_R, p_B, p_W) \mid p_R = \frac{1}{3},\ p_B, p_W \geq \frac{1}{6},\ p_B + p_W = \frac{2}{3} \right\}.$$

Show that given the set of prior beliefs, the above choice behaviour can be explained by the MEU.