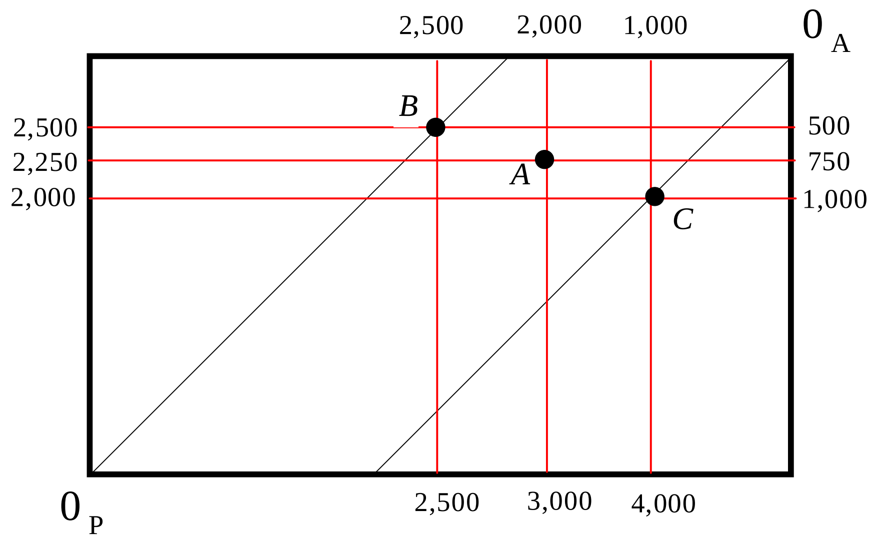
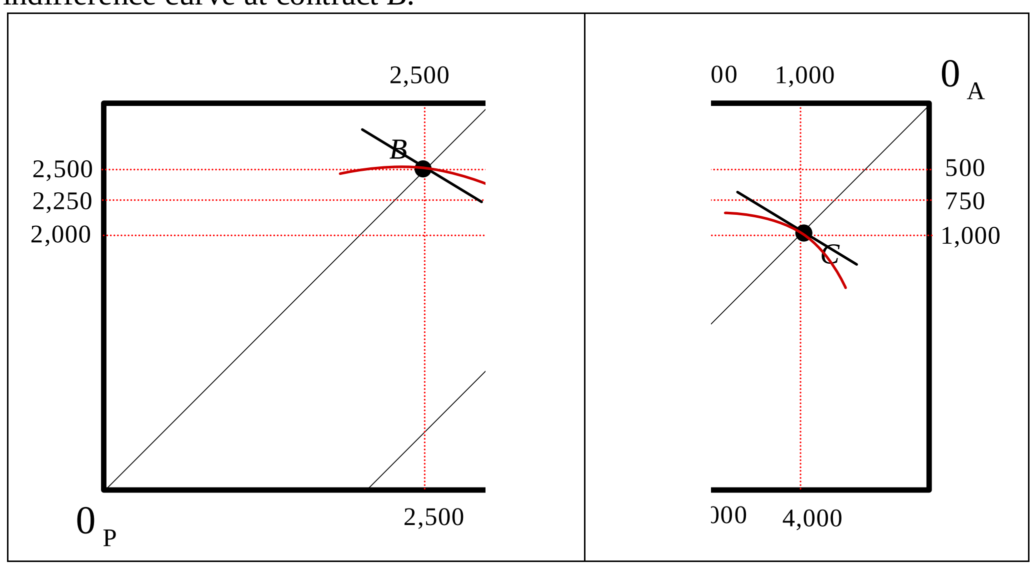
ECN 103 Professor Giacomo Bonanno

THIRD MIDTERM EXAM: ANSWERS for VERSION 1

1. **(a.1)**



(a.2) See below. The straight lines are the Principal's indifference curves and the curved lines are the Agent's indifference curves. The two indifference curves are tangent at contract *C*, while the Agent's indifference curve is less steep than the Principal's indifference curve at contract *B*.



(b) Pareto efficiency requires that the risk-averse party be guaranteed a fixed salary. Thus the only Pareto efficient contract is contract *C* (which is on the 45^o line for the Agent).

(c) From the Agent's point of view, contract *A* is the lottery $\begin{pmatrix} 2{,}000 & 750 \\ \frac{1}{4} & \frac{3}{4} \end{pmatrix}$ whose expected utility is $\frac{1}{4}\sqrt{2{,}000}+\frac{3}{4}\sqrt{750}=31.72$, contract *B* is the lottery $\begin{pmatrix} 2{,}500 & 500 \\ \frac{1}{4} & \frac{3}{4} \end{pmatrix}$ whose expected utility is $\frac{1}{4}\sqrt{2{,}500}+\frac{3}{4}\sqrt{500}=29.27\,2$ and contract *C* is the sure lottery

$\begin{pmatrix} 1{,}000 \\ 1 \end{pmatrix}$ whose expected utility is $\sqrt{1{,}000} = 31.623$. Thus the Agent ranks the contracts as follows: $A \succ C \succ B$.

2. **(a)** **(a.1)** If p = 2.5 then only qualities 1 and 2 will be offered for sale, thus only $\frac{2}{10} + \frac{1}{10} = \frac{3}{10}$ of the iPhones are offered for sale. Hence 1,500 iPhones. **(a.2)** $\begin{pmatrix} 1 & 2 \\ \frac{2}{3} & \frac{1}{3} \end{pmatrix}$. **(a.3)** $1 + \left(\frac{2}{3}1 + \frac{1}{3}2\right) - 2.5 = -1.167$.

(b) **(b.1)** If p = 4.3 then 100% of the iPhones are offered for sale, that is, all 5,000 of them.
(b.2) $\begin{pmatrix} 1 & 2 & 3 & 4 \\ \frac{2}{10} & \frac{1}{10} & \frac{4}{10} & \frac{3}{10} \end{pmatrix}$. **(b.3)** $1 + \left(\frac{2}{10}1 + \frac{1}{11}2 + \frac{4}{10}3 + \frac{3}{10}4\right) - 4.3 = -0.5$.

(c) **(c.1)** If p = 3.2 then only qualities 1, 2 and 3 will be offered for sale, thus only $\frac{2}{10} + \frac{1}{10} + \frac{4}{10} = \frac{7}{10}$ of the iPhones are offered for sale. Hence 3,500 iPhones. **(c.2)** $\begin{pmatrix} 1 & 2 & 3 \\ \frac{2}{7} & \frac{1}{7} & \frac{4}{7} \end{pmatrix}$. **(c.3)** $1 + \left(1\frac{2}{7} + 2\frac{1}{7} + 3\frac{4}{7}\right) - 3.2$ = 0.086.

3. **(a)** Only the b types would buy. Thus expected profits are $1000(600 - \frac{1}{30}12000) = 200{,}000$.

(b) Only the b types would buy and they would all choose contract C. Thus expected profits are 200,000 as in case (a).

(c) Type a would choose contract A and type b would choose contract C. Thus expected profits are 200,000 from type b and $1000[200 - \frac{1}{60}(12000 - 1200)] = 20{,}000$ from type a, for a total of 220,000.