Microeconomics Paper 210526

1a $u_A(x_A, y_A) = x_A y_A^3$
$u_B(x_B, y_B) = 16 x_B y_B$
$\omega_A = (8,8)$
$\omega_B = (0,0)$
$p_y = 1$, $p_x = p$

~~max~~ ~~x_A, y_A~~

The utilitarian criterion maximises total utility

$\max_{x_A, y_A, x_B, y_B} u_A(x_A, y_A) + u_B(x_B, y_B)$ s.t.
$x_A + x_B \leq 8$, $y_A + y_B \leq 8$

Utilities are strictly increasing in each good, so at the optimum, both constraints bind. The above reduces to

$\max_{x_A, y_A} u_A(x_A, y_A) + u_B(8-x_A, 8-y_A)$

$FOC_x: y_A^3 - 16(8-y_A) = 0$
$FOC_y: 3x_A y_A^2 - 16(8-x_A) = 0$
$(x_A, y_A) = (2,4)$ uniquely solves the FOCs. The SOC for a maximum is satisfied. The allocation $(x_A, y_A) = (2,4)$, $(x_B, y_B) = 6,4$ ~~solves~~ maximises the total utility hence ~~satisfies~~ is optimal according to the utilitarian criterion.

Total utility is maximised at this allocation, so no one consumer's utility can be increased ~~to~~ without decreasing the other consumer's. The allocation is pareto efficient.

b At the CE, price ratio is equal to the common MRS. Otherwise, some consumer has a profitable exchange at the given price.
$-p = MRS_A = -MU_x^A / MU_y^A = -y_A^3 / 3x_A y_A^2 = -y_A / 3x_A = -2/3$
$p = 2/3$.

The intersection of the $p = 2/3$ ~~price~~ budget line through the CE allocation with the ~~$x=8$~~ $x_A = 8$ line is such that
$y_A - 4 = -2/3(8-2) \Leftrightarrow y_A = 0$
All 8 units of y must be transferred from A to B.

c Suppose for reductio that at the Rawlsian allocation, $u_A(x_A, y_A) \neq u_B(x_B, y_B)$. Note that for ~~non-zero allocations such that each consumer has non-zero utility~~, utility is strictly increasing in each good for each consumer (except in degenerate cases). Then, the worse off consumer can be made better off by some small transfer of either good, such that ~~the~~ this consumer remains the worse off consumer.

Then minimum utility can be increased, and the initial allocation does not maximise minimum utility. By reductio, at the ~~Rawls~~ Rawlsian allocation, $u_A(x_A, y_B) = u_B(x_B, y_B)$.

~~At~~ Any candidate Rawlsian ~~soln~~ optimum such that $MRS_A \neq MRS_B$, there is some mutually profitable exchange between A and B, i.e. some alternative allocation that lies strictly above the indifference curves of both consumers. Deviation to this allocation increases each ~~player's~~ consumer's utility, so increases minimum utility. The initial ~~candi~~ candidate Rawlsian optimum fails to this deviation.

A further necessary condition is that the endowment is exhausted. These three conditions are ~~a~~ jointly sufficient for a Rawlsian optimum (given well-behaved preferences). If the endowment is not exhausted, both consumers can be made better off by a small increase in each of their allocations of either good.

2a A has utility maximization problem

$$\max_{y,\, m_A} u_A(y, m_A) \text{ s.t.}$$
$$BC: m_A \leq m_A^* - 40y$$

At the optimum, the budget constraint BC binds. The above reduces to

$$\max_{y} u_A(y, m_A^* - 40y)$$

FOC: $42 - 2y - 40 = 0 \Rightarrow y = 1$
SOC: $-2 < 0$

A maximises utility by choosing $y=1$, which implies $h = 1/5$.

The Pareto optimum maximises total utility

$$\max_{y} u_A(y, m_A^* - 40y) + u_B(y, m_B^*)$$

FOC: $42 - 2y - 40 + \frac{1}{2}y + 4 = 0 \Rightarrow y = 4$
SOC: $-3/2 < 0$

The Pareto optimal number of trees is $y=4$.

In the first scenario:
$u_A(y=1, m_A = m_A^* - 40) = 42(1) - (1)^2 + m_A^* - 40 = m_A^* + 1$
$u_B(y=1, m_B = m_B^*) = \frac{1}{4}(1)^2 + 4(1) + m_B^* = m_B^* + 17/4$

In the second scenario:
$u_A(y=4, m_A = m_A^* - 160) = 42(4) - (4)^2 + m_A^* - 160$
$= m_A^* - 8$
$u_B(y=4, m_B = m_B^*) = \frac{1}{4}(4)^2 + 4(4) + m_B^* = m_B^* + 20$

Neither scenario Pareto dominates the other. A is better off in the first scenario, by construction of that scenario, B is better off in the second scenario because more trees are produced at zero cost to B. B free rides on A's production of trees, which has a positive externality on B.

b ~~The minimum transfer A~~ A's outside option is to produce the privately optimal amount of trees $y=1$. This yields utility $m_A^* + 1$, which is A's reservation utility. A contract under which A produces $y=4$ and receives payment t yields utility $m_A^* - 8 + t$ to A. This is ~~acc~~ optimal for A iff $m_A^* - 8 + t \geq m_A^* + 1 \Leftrightarrow t \geq 9$.

B's outside option is to have A produce A's privately optimal amount of trees $y=1$ and pay A nothing. This yields utility $m_B^* + 17/4$ for B, which is B's reservation utility. The contract under which A produces $y=4$ and receives transfer t from B yields $m_B^* + 20 - t$ for B.

This contract is optimal for B iff $m_B^* + 20 - t \geq m_B^* + 17/4$, ~~[illegible]~~ $\Leftrightarrow t \leq 20 - 17/4 = 63/4$.

The contract of the above form is acceptable to both A and B iff $9 \leq t \leq 15\frac{3}{4}$.

c Utility functions of both colleges are quasilinear in money. This simplified the above analysis. Because of quasilinearity in money, the range of acceptable contracts can be found simply as the range bounded by difference in absolute utility amounts of A and B. Otherwise, a more complicated computation would have been required.

3a $\pi_2(q_2, q_1) = q_2(p(q_1+q_2) - c_2)$
$= q_2(\alpha - q_1 - q_2 - c_2)$

maximise wrt q_2

FOC: $(\alpha - q_1 - q_2 - c_2) - q_2 = 0 \Rightarrow q_2 = {\alpha - q_1 - c_2}/{2}$

SOC: $-2 < 0$

~~By symmetry~~

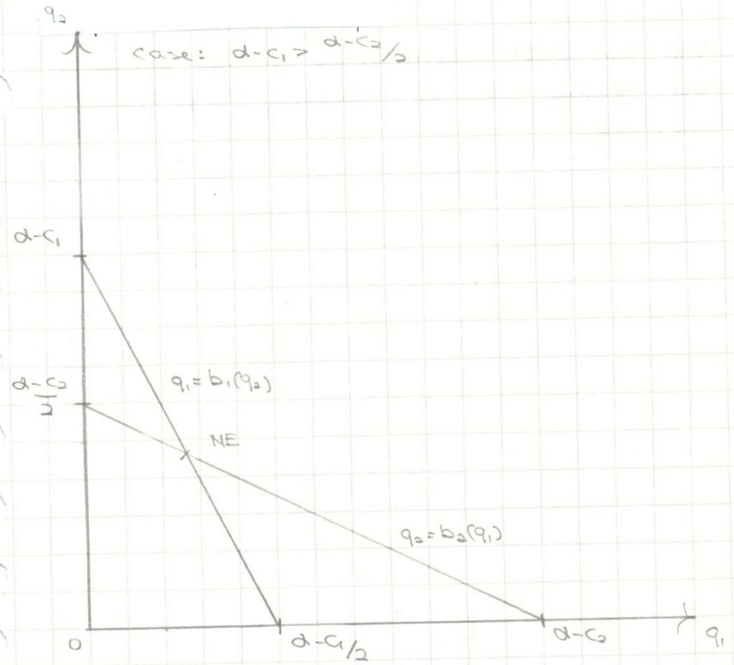
$q_2 = {\alpha - q_1 - c_2}/{2}$ maximises π_2

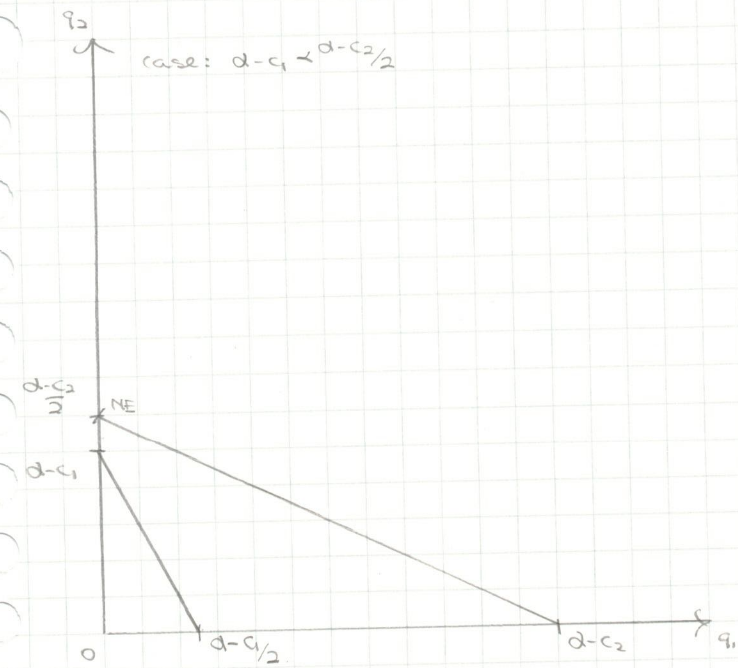
By symmetry, $q_1 = {\alpha - q_2 - c_1}/{2}$ maximises π_1.

Best response functions

$$b_1(q_2) = \begin{cases} {\alpha - q_2 - c_1}/{2} & \text{if } q_2 \le \alpha - c_1 \\ 0 & \text{if } q_2 > \alpha - c_1 \end{cases}$$

$$b_2(q_1) = \begin{cases} {\alpha - q_1 - c_2}/{2} & \text{if } q_1 \le \alpha - c_2 \\ 0 & \text{if } q_1 > \alpha - c_2 \end{cases}$$





The Cournot Nash of each game is ~~#~~ represented by the point labelled NE.

In the first case, Cournot NE is such that both firms produce non-zero output. In the second case, only firm 2, the more efficient firm, produces non-zero output. In either case, firm 2, the more efficient firm, produces higher output.

In the first case, NE quantities are found by substitution of best responses. ~~$q_1^* =$~~

$q_1^* = {\alpha - c_1}/{2} - {q_2^*}/{2}$

$= {\alpha - c_1}/{2} - \frac{1}{2}\left({\alpha - c_2}/{2} - {q_1^*}/{2}\right) \Leftrightarrow$

${3q_1^*}/{4} = {\alpha - 2c_1 + c_2}/{4} \Leftrightarrow$

$q_1^* = {\alpha - 2c_1 + c_2}/{3}$

By symmetry,
$q_2^* = {\alpha - 2c_2 + c_1}/{3} > q_1^*$

In the second case, $q_1^* = 0$, $q_2^* = {\alpha - c_2}/{2}$. In this case, firm 2 is so much more efficient than firm 1 that even when firm 2 produces its monopoly output, the equilibrium price is lower than c_1, so firm 1 optimally produces zero output in response.

In either case, firm 2 produces higher output because it has lower marginal cost, hence higher margins, hence greater incentive to produce high output.

4a. Reservation utility is equal to utility from the outside option.
$\bar{u} = u(36, 2) = \sqrt{36} - 2 = 4$

Principal P offers worker W the minimum wage such that participation in the project is optimal.
$u(w_0, e=0) = \bar{u} \iff$
$w_0 = 16.$

$u(w_1, e=1) = \bar{u} \iff$
$w_1 = 25$

$E[\pi - w_0 \mid e=0] = 3/4(30-16) + 1/4(70-16) = 24$
$E[\pi - w_1 \mid e=1] = 1/2(30-25) + 1/2(70-25) = 25$

Expected net (of wage) profit to P from the optimal high effort contract is 25 and is greater than the expected net profit from the optimal low effort contract, so the high effort contract is optimal for P.

b. P optimally induces low effort by offering the fixed wage contract with $w(\pi_L) = w(\pi_H) = w_0 = 16$. From the above, this satisfies W's participation constraint. The incentive constraint is trivially satisfied because, given a fixed wage and positive disutility of effort, utility is maximised by zero effort. From the above, this ~~also~~ maximises expected profit subject to PC and IC, so it is the optimal contract for inducing low effort.

P's profit maximisation problem in inducing high effort ~~is~~ consists in exp. wage minimisation subject to PC and IC.

$\min_{w_L, w_H} \frac{1}{2}w_L + \frac{1}{2}w_H$ s.t.
PC: $\frac{1}{2}u(w_L, e=1) + \frac{1}{2}u(w_H, e=1) \geq \bar{u} \iff$
$\frac{1}{2}\sqrt{w_L} + \frac{1}{2}\sqrt{w_H} - 1 \geq 4$
IC: $\frac{1}{2}u(w_L, e=1) + \frac{1}{2}u(w_H, e=1) \geq$
$\frac{3}{4}u(w_L, e=0) + \frac{1}{4}u(w_H, e=0) \iff$
$\frac{1}{2}\sqrt{w_L} + \frac{1}{2}\sqrt{w_H} - 1 \geq \frac{3}{4}\sqrt{w_L} + \frac{1}{4}\sqrt{w_H}$

At the optimum both constraints bind. Any candidate optimum such that PC does not bind fails to deviation by decreasing w_L by small amount ε. Any candidate optimum such that IC does not bind fails to deviation consisting in a small mean preserving contraction of w_L and w_H and a small decrease in w_L.

Solve simultaneously
Binding PC $\Rightarrow \frac{1}{2}\sqrt{w_L} + \frac{1}{2}\sqrt{w_H} = 5$
Binding IC $\Rightarrow \frac{1}{4}\sqrt{w_H} - \frac{1}{4}\sqrt{w_L} = 1$

$\Rightarrow \sqrt{w_L} + \sqrt{w_H} = 10, \quad \sqrt{w_H} - \sqrt{w_L} = 4$
$\Rightarrow w_H = 49, \quad w_L = 9$

The optimal contract to induce high effort is $(w_H, w_L) = (49, 9)$

Expected wage is $\overset{1/2}{\cancel{3/4}}(49) + \overset{1/2}{\cancel{1/4}}(9) = \overset{29}{\cancel{39}}$

Agency cost is the increase in expected wage relative to the observable effort case. This is $\underset{29}{\cancel{39}} - 25 = \overset{4}{\cancel{14}}$.

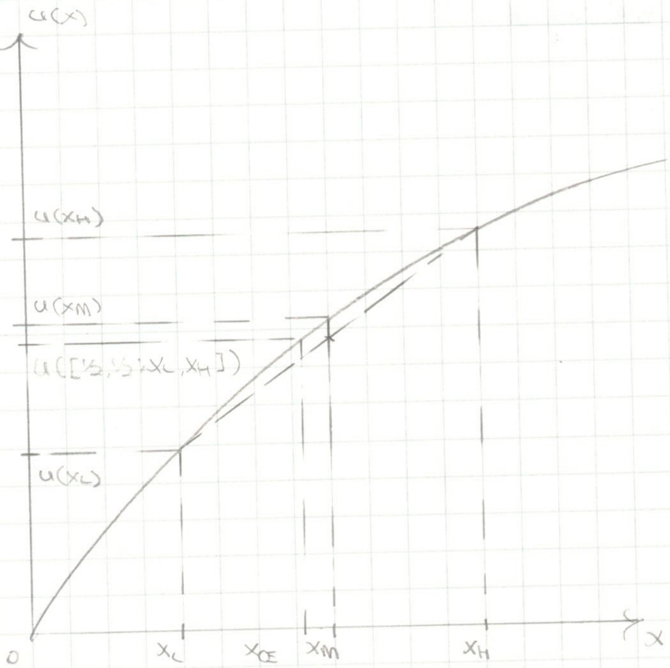
Expected net profit is $\overset{1/2}{\cancel{3/4}}(70) + \overset{1/2}{\cancel{1/4}}(30) - \overset{29}{\cancel{39}} = \overset{21}{\cancel{11}}$.

~~The opt~~ Expected net profit from the low effort contract is unchanged at 24.

The low effort contract is optimal because the agency cost in inducing high effort is too large.

8 Suppose that some agent ~~A~~ is an expected utility maximiser with Bernoulli utility u on final wealth levels in final wealth. Consider arbitrary lottery with discrete outcomes $L = [p_1, \dots, p_n ; x_1, \dots, x_n]$. Then this agent ~~A's~~ expected utility from L is $U(L) = \sum_{i=1}^{n} p_i u(x_i)$. More generally, for lottery in final wealth L with cumulative distribution function (cdf) F, ~~U~~ $U(L) = \int_{-\infty}^{\infty} u(x) F'(x)\,dx$. In words, this agent ~~A~~'s expected utility from arbitrary lottery L is the expected value of Bernoulli utility given L. If this agent ~~A~~ maximises expected utility, this agent ~~A~~ chooses the lottery from among those available that yields the maximum expected utility.

A is risk averse iff u is concave, i.e. $u''(x)<0$ for all final wealth values x. Concavity implies that A's expected utility from some risky lottery is lower than A's Bernoulli utility from the expected value ~~of~~ (EV) of that lottery. $EV(L) = \sum_{i=1}^{n} p_i x_i$ for continuous lotteries, $EV(L) = \int_{-\infty}^{\infty} x F'(x)\,dx$. For example, consider the following concave utility function.



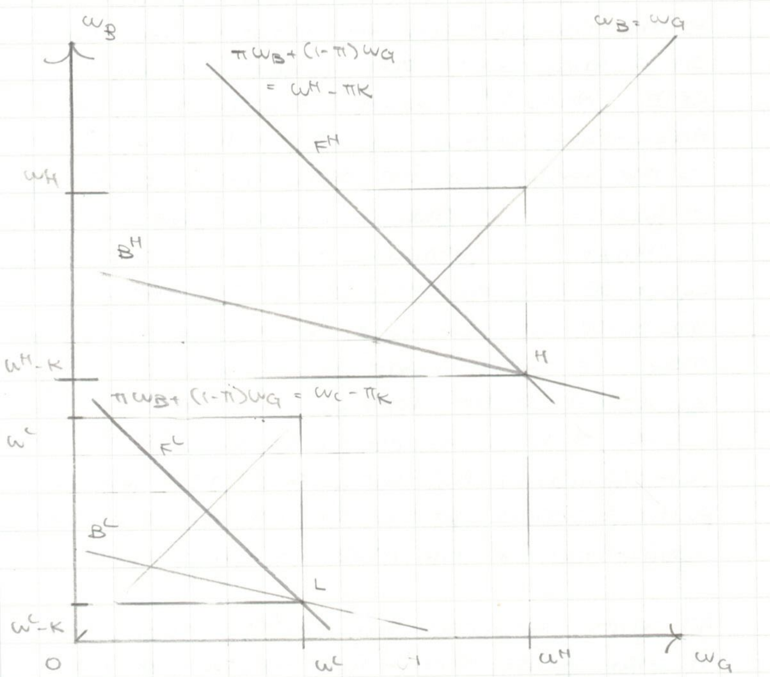
$EV([1/2, 1/2 ; x_L, x_H]) = 1/2\,x_L + 1/2\,x_H = x_M$.
$U([1 ; x_M]) = u(x_M) > U([1/2, 1/2 ; x_L, x_H])$

The expected utility of the risky lottery $[1/2, 1/2 ; x_L, x_H]$ is less than the Bernoulli utility of this lottery's expected value. this agent strictly ~~A~~ prefers ~~the~~ to receive the expected value of the lottery with certainty than to participate in the lottery. Equivalently, this lottery ~~has~~ (and any risky lottery, to a risk averse agent) has certainty equivalent (CE) less than its EV, hence positive risk premium. $CE(L)$ is such that $[1 ; CE(L)] \sim L$, which is iff, ~~for~~ (for an expected utility maximiser, $u(CE(L)) = U(L)$. The CE of $[1/2, 1/2 ; x_L, x_H]$ is ~~given by~~ represented by x_{CE}. $RP(L) = EV(L) - CE(L)$. This is graphically represented by ~~x_{CE}~~ $x_M - x_{CE}$. A risk averse agent with concave Bernoulli utility always has strictly positive risk premium on any risky lottery.

One agent is more risk averse than another iff the ~~A~~ Bernoulli utility function of the former is more concave than the Bernoulli utility function of the latter. Formally, ~~the conc~~ risk aversion, and the concavity of the ~~B~~ Bernoulli utility function is measured by the Arrow-Pratt measure ~~A~~: $A = -u''(x)/u'(x)$. The larger the value of A, the greater the risk aversion of the ~~agent with B~~ expected utility maximiser with Bernoulli utility u. ~~AA~~ An agent's Arrow-Pratt measure of risk aversion is proportionate to the risk premium evaluated by that agent on a small mean-zero gamble. Precisely, $RP \approx 1/2\,A(w)\sigma^2$, where $A(w)$ is the agent's Arrow-Pratt measure at wealth level w, and σ^2 is the variance of the small mean-zero lottery. In general, a more risk averse agent will have a higher risk premium than a less risk averse agent on a given risky lottery. The lottery has the same expected value for both agents, so the more risk averse agent has a lower certainty equivalent on the lottery. Then, there are some values of final wealth in the event of non-participation in the lottery such that ~~partici~~ participation is optimal for the less risk averse agent than for the more risk averse agent.

An agent's preferences over lotteries exhibits DARA iff that agent's Arrow-Pratt measure of risk aversion is decreasing with wealth, i.e. $A(x)$ is decreasing in x. A special case of DARA is when an agent's risk aversion is inversely ~~proportionate~~ ~~to~~ related to wealth x. Such agents have constant relative risk aversion CRRA, with coefficient r, which ~~implies~~ means that their ~~absolute measur~~ relative ~~Arr~~ Arrow Pratt measure $R(x) = -u''(x)x/u'(x) = r$. For $r=1$, this implies $u(x) = \ln x$. For $r<1$, this implies $u(x) = x^{1-r}$. Agents with ~~A~~ DARA accept more risky gambles (~~in~~ not in final wealth, but in change in wealth) at higher wealth levels; their risk premiums for lotteries in ~~in~~ wealth changes decreases as initial wealth increases. In the case of a two-outcome gamble with fixed probabilities, their higher indifference curves ~~become~~ are less convex in ~~be~~ ~~x~~ final wealth under outcome 1, final wealth under outcome 2 space

Professional athletes insure themselves against injury, whereas amateur athletes (in general) do not, and the former are more wealthy than the latter. This suggests that ~~profess~~ more wealthy professional athletes are more risk averse, not less, than less wealthy amateur athletes. Consider the following simplified model of the situation. A ~~profes~~ professional athlete with initial wealth w^H faces potential loss K with probability π. An amateur athlete with initial wealth w^L faces a potential loss of the same amount with ~~probability~~ the same probability. Denote the outcome that the loss occurs as B (Bad) and the outcome that no loss occurs as G (Good). Each athlete is offered actuarially unfair insurance at premium $p > \pi$.



The professional athlete's uninsured position is H. ~~at~~ The line F^H is the budget line for ~~the~~ the ~~prof~~ professional athlete if offered actuarially fair insurance, the line B^H is the budget line given actuarially unfair insurance. Likewise for L.

If the professional athlete insures, this is because some point along B^H ~~is~~ lies ~~above the~~ ~~indif this athlete's insurance curve~~ (to the left of H) lies above this athlete's indifference curve through H. Then, this indifference curve at H is less steep than B^H. If the amateur athlete does not insure, this is because no point on B^L to the left of L lies above this amateur athlete's indifference curve through L. This indifference curve is steeper than B^L at L. This implies that the amateur athlete is less risk averse than the professional because the ~~amateur is less willing to~~ professional is willing to trade off more wealth in outcome G for the same increase in wealth in outcome B. This violates the assumption of DARA.

Several assumptions in the above argument are implausible or unrealistic to the situation. First, the loss faced by the professional is significantly larger than that faced by the amateur because an injury ~~constitutes a~~ causes a loss of income for the professional but not for the amateur. So the risk faced by the professional is much greater, and insurance need not indicate greater risk aversion. Second, the professional is potentially offered more actuarially fair insurance than amateurs because the risks faced by the professional are better known, and the probability of fraud (hence associated costs in administering payouts, which are in part passed on by insurers to agents) are much lower. ~~Third, the risk of~~

10a $L_W = [0.4, 0.3, 0.3;\ 36, 36, 25]$

$L_R = [0.4, 0.3, 0.3;\ 64, 36, 9]$

$L_S = [0.4, 0.3, 0.3;\ 100, 36, 0]$

$EV(L_W) = 0.4 \times 36 + 0.3 \times 36 + 0.3 \times 25 = 32.7$

$EV(L_R) = 0.4 \times 64 + 0.3 \times 36 + 0.3 \times 9 = 39.1$

$EV(L_S) = 0.4 \times 100 + 0.3 \times 36 + 0.3 \times 0 = 50.8$

$EV(L_S)$ is the highest.

$u(L_W) = 0.4u(36) + 0.3u(36) + 0.3u(25)$

$= 0.4\sqrt{36} + 0.3\sqrt{36} + 0.3\sqrt{5}$

$= 5.7$

$u(L_R) = 0.4\sqrt{64} + 0.3\sqrt{36} + 0.3\sqrt{9} = 5.9$

$u(L_S) = 0.4\sqrt{100} + 0.3\sqrt{36} + 0.3\sqrt{0} = 5.6$

L_R maximises expected utility. G optimally chooses L_R.

G does not simply choose the lottery with the highest EV because G is risk averse, this is evident from the concavity of Bernoulli utility $u(x) = \sqrt{x}$ ($u'(x) = \frac{1}{2}x^{-1/2}$, $u''(x) = -\frac{1}{4}x^{-3/2} < 0$). ~~By concavity of Bernoulli utility u,~~ L_S has higher EV than L_R because it yields much larger final wealth in the Good outcome and ~~lower~~ only slightly lower final wealth in the Bad outcome. It has lower EU because the small difference in wealth at low wealth levels is equivalent to a large difference in Bernoulli utility because of concavity of u.

b Yes.

~~By inspection of the~~ Expected utility is additive in the sense that it is computed by ~~ad~~ summing the products of probability and Bernoulli utility of each outcome. So uniformly changing the outcome in one event (OK) which has fixed and common probability, with a different final wealth level hence a different Bernoulli utility, has an equal effect on the expected utility of all three lotteries, $(0.3\sqrt{33} - 0.3\sqrt{36})$. So L_R continues to maximise expected utility.

$L_W = [0.3, 0.7;\ L_0, L_W']$

$L_R = [0.3, 0.7;\ L_0, L_R']$

$L_S = [0.3, 0.7;\ L_0, L_S']$

where $L_0 = [1;\ 36]$, $L_W' = [4/7, 3/7;\ 36, 25]$, $L_R' = [4/7, 3/7;\ 64, 9]$, $L_S' = [4/7, 3/7;\ 100, 0]$. Uniformly substituting L_0 with L_0' has no effect on all expected utility maximisers preferences over the W, S, and R lotteries, because such preferences satisfy independence.

c $L_C = [0.4, 0.3, 0.3;\ 100-21, 36-21, 36-21]$

$= [0.4, 0.3, 0.3;\ 79, 15, 15]$

$u(L_C) = 0.4\sqrt{79} + 0.3\sqrt{15} + 0.3\sqrt{15} = 5.8791 < u(L_R)$

$\Rightarrow L_R \succ L_C$

G prefers to grow R than to grow S even under the C insurance plan, so G will not accept the C insurance contract.

d Let L_{SW} denote the lottery ~~faced by~~ in final wealth faced by each farmer under the given plan.

$L_{SW} = [0.4, 0.3, 0.3;\ {}^{100+36}/_2, 36, {}^{25+0}/_2]$

$= [0.4, 0.3, 0.3;\ 68, 36, {}^{25}/_2]$

$u(L_{SW}) = 0.4\sqrt{68} + 0.3\sqrt{36} + 0.3\sqrt{25/2} = 6.1591$

$> u(L_R) > u(L_S) > u(L_W) \Rightarrow$

$L_{SW} \succ L_R, L_S, L_W$

The ~~ste~~ shared, diversified lottery yields higher expected value than any unshared lottery. In fact, it first-order stochastically dominates the most-preferred unshared lottery L_R. In each event, L_{SW} yields higher final wealth than L_R (and in two events, strictly so). ~~The shared lottery is prefe~~ Any expected utility maximiser prefers L_{SW} to L_R.

e $L_{SW}(\lambda) = [0.4, 0.3, 0.3;\ \lambda 36 + (1-\lambda)100, 36, \lambda 25]$

$u(L_{SW}(\lambda)) = 0.4\sqrt{36\lambda + 100(1-\lambda)} + 0.3\sqrt{36} + 0.3\sqrt{25\lambda}$

$\max_\lambda u(L_{SW}(\lambda))$

FOC: $0.4(\frac{1}{2})(100-64\lambda)^{-1/2}(-64) + 0.3(\frac{1}{2})(25\lambda)^{-1/2}(25) = 0 \Leftrightarrow$

$-\frac{64}{5}(100-64\lambda)^{-1/2} + \frac{15}{4}(25\lambda)^{-1/2} = 0 \Leftrightarrow$

$\frac{15}{4}(25\lambda)^{-1/2} = \frac{64}{5}(100-64\lambda)^{-1/2} \Leftrightarrow$

$(25\lambda)^{-1/2} = \frac{256}{75}(100-64\lambda)^{-1/2} \Leftrightarrow$

$25\lambda = \frac{5625}{65536}(100-64\lambda) \Leftrightarrow$

$(25 + \frac{5625}{1024})\lambda = \frac{562500}{65536} \Leftrightarrow$

$\lambda = \frac{5625}{19984} = 0.28148$

~~SOC:~~

$\lambda = 0.28148$ maximises EU for each participating farmer.

f Outcomes of farmers in the same region are perfectly correlated. The shared lottery is identical to the unshared lottery (each farmer has a $1/n$ stake in n perfectly correlated lotteries, which is equivalent to a $1/n$ stake in ~~a~~ a ~~lottery~~ wheat lottery with payoffs n times that of the ordinary wheat lottery, which is simply equivalent to the ordinary wheat lottery).

Outcomes for ~~≠~~ G and M are independent so risk pooling is possible and mutually profitable. The pooled lottery is less risky for each participant than the ~~up~~ unpooled lottery because the distribution of outcomes in the pooled lottery is more tightly centered around the mean (which is unchanged) than the distribution of outcomes in the unpooled lottery. The worst outcome of the unpooled lottery occurs with lower probability in the pooled lottery because this requires Bad to be realized in both independent regions. Likewise for the best outcome. The pooled lottery second-order stochastically dominates the unpooled lottery, and is strictly preferred by any risk-averse expected utility maximiser. It has the same expected value but higher expected utility because of the concavity of Bernoulli utility u. It is a mean preserving contraction of the unpooled lottery.