Microeconomics B01.1303
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Solutions to problem set 3

1. a) $60 - 10 = 2M + 1*30 \Rightarrow M = 10$
   b) $60 = 2M + 2B$
   c) $60 = 2M + 2*20 \Rightarrow M = 10$
   d) Rev = 1*B = $20
   e) $60 = (P_M + tP_M)M + (P_B + tP_B)B$
   $= (2 + 2t)M + (1 + t)B$

We also know that when M = 10 and B = 20, government revenue equals $20. Therefore this point must fall on the line where revenue equals $20.

$$60 = 2(1 + t)10 + (1 + t)20 \Rightarrow t = 0.5,$$

i.e., the tax rate is 50%. Therefore the new price of beer with the tax is $1.50, and the new price of meat pies is $3.00. The equation for this line can therefore be written as:

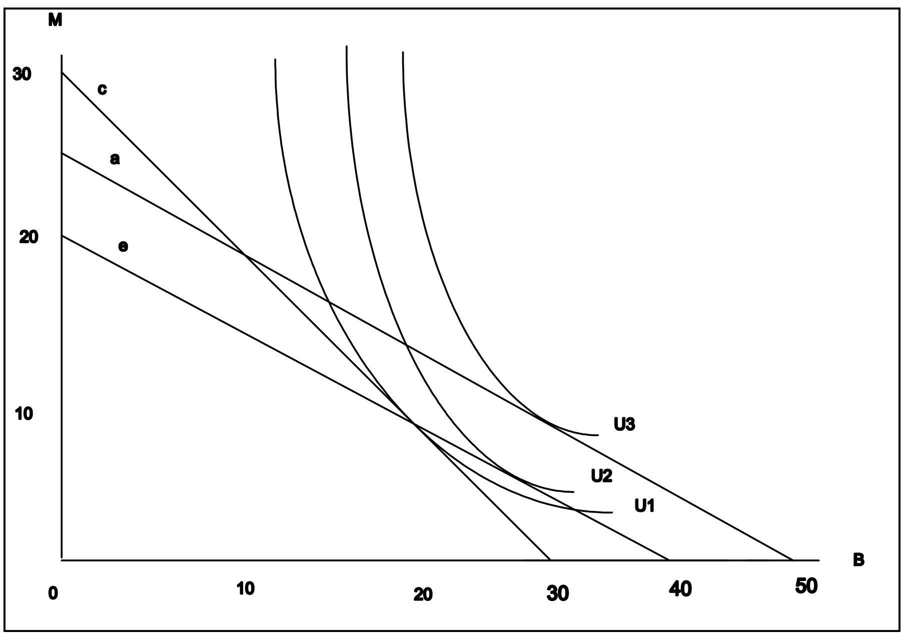
$$60 = 3M + 1.5B$$

Similarly, if you just subtract the $20 in tax from income as if it were an income tax (which you can only do because Norm and Sheila spent all their income on meat pies and beer), you get the following equation:

$$40 = 2M + B$$

this equation is the first equation divided by 1.5, therefore represents the same line.

f) Norm and Sheila are better off with the tax on both goods. Because there is an indifference curve (U1) tangent to line (c) at (20, 10), there must be a higher indifference curve (U2) tangent to (e). See graph. Norm and Sheila will consume more beer and be happier.



2. a)

| SCHOOL | SAFETY<br>no govt. assistance | SAFETY<br>with prog. (1) | SAFETY<br>with prog. (2) |
|---|---|---|---|
| $0 | $300,000 | $400,000 | $400,000 |
| $50,000 | $250,000 | $350,000 | $350,000 |
| $100,000 | $200,000 | $300,000 | $300,000 |
| $150,000 | $150,000 | $250,000 | $250,000 |
| $200,000 | $100,000 | $200,000 | $200,000 |
| $250,000 | $50,000 | $150,000 | $100,000 |
| $300,000 | $0 | $100,000 | $0 |

b) Allocation to safety is the same in each program ($350,000) if $50,000 is allocated to school. When $250,000 is given to school, program 1 will give $150,000 whereas program 2 will contribute $100,000 to safety. Clearly, program 1 is preferred.

c) With no aid, $300,000 can be divided in any proportion among school and safety so the budget constraint should be:

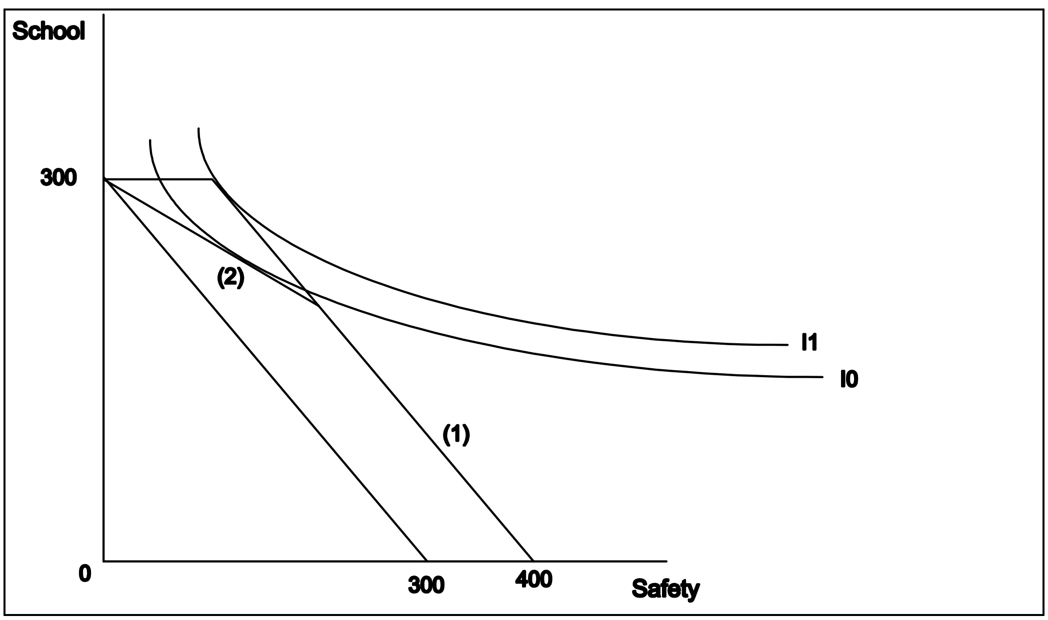
S: allocation to school

Y: allocation to safety

Therefore: $S + Y = 300{,}000$

This is a straight line with a S-intercept and a Y-intercept of 300,000.

With program 1, there are two line segments. A horizontal line hits the school-axis at 300,000 and a downward-sloping straight line hits the safety-axis at 400,000. For program 2, the budget constraint has two line segments, one from (0, 300,000) to (200,000, 200,000) and another from (200,000, 200,000) to (400,000, 0). See graph. Notice that every point in the budget set of program 2, is also available under the budget constraint of program 1. Therefore the city is at least as well off with program 1 as with program 2. A closer examination of the indifference curves shows that the city is strictly better off with program 1, and therefore it should choose it.




3. a) Suppose George is faced with a gamble that pays $10,000 with a probability of 1/2 and $100 with a probability of 1/2. The expected dollar value of the gamble is (1/2)(10000) + (1/2)(100) = $5050. The utility value of the gamble is (1/2)U(10000) + (1/2)U(100) = 1/2(100) + 1/2(10) = 55. The utility value of

receiving \$5050 with certainty is $U(5050) = (5050)^{0.5} = 71.06$. Clearly, $(5050)^{0.5} > 55$. He prefers the certain situation and, therefore, he is risk averse.

b) The expected utility of the new job lottery is $0.5*160000^{0.5} + 0.5*40000^{0.5} = 300$, which is less than George's current utility of his income \$100,000 (which is $100000^{0.5} = 316$). So, he should not leave his old job. The certainty equivalent of the lottery is $(0.5*160000^{0.5} + 0.5*40000^{0.5})^2 = (0.5*4*10000^{0.5} + 0.5*2*10000^{0.5})^2 = (3*10000^{0.5})^2 = \$90,000$.

c) Let X be his income in the low-paying job. He must receive the same utility from the lottery and the certain situation. Therefore, the utility of the new job lottery should be

$$0.5*U(160000) + 0.5*U(X) = 316.$$

Multiplying by 2 and rearranging, this is equivalent to

$$U(X) = 632 - U(160000) = 632 - 400$$

$$\Leftrightarrow X^{0.5} = 232$$

$$\Leftrightarrow X = (232)^2 = \$53,824.$$

Therefore, if he receives \$53,824 in the low-paying job, he is just indifferent between the lottery and the old job.