

- The duration of the exam is 1 hour 20 minutes.
- The exam consists of 8 problems and it is worth 100 points. The extra credit problem will only be counted if you lose points on other problems.
- Please write in the space provided. If necessary, write on the back of the page.
- Please ask me if you have any questions.
- To receive full credit you have to carefully explain all your answers and show all your work.

General advice: *If you get stuck in the early parts of a problem, do not stop there. You can receive substantial partial credit by explaining how you would solve the rest of problem if you had the necessary answers from its previous parts.*

1. (15 points) Determine whether each of the statements is true or false:
  - a. Adverse Selection results from the fact that people who anticipate health problems in the future are more likely to buy health insurance.

**True. The ability of individuals to choose whether to buy health insurance based on their own (unobserved by insurers) health risks is necessary condition for adverse selection.**

- b. When choosing the preferable project among all admissible projects the benefit-cost ratio method will lead to exactly the same result as net present discounted value method.

**False. The benefit-cost ratio method is not reliable as far as comparing admissible projects is concerned because any project's benefit-cost ratio can be manipulated and made arbitrarily high by using the fact that costs are just negative benefits.**

- c. Cost-benefit analysis assumes that the value of human life is infinite.

**False. If human life were treated as infinitely valuable, any project that would save one man's life would be preferred to any other project (however good) that doesn't save anybody's life. For example, no project related to education would likely pass because education's primary benefits have little to do with saving lives.**

- d. The Primary Insurance Amount is calculated in such a way that a poor person's replacement ratio (benefit-to-earnings ratio) is higher than a rich person's.

**True. PIA constitutes higher proportion of AIME for low incomes than for higher incomes.**

- e. Social Security System doesn't benefit young generations at all because they put more in the system than they will get back.

**False. Even if that were the case, any risk-averse individual from any generation benefits from having insurance.**

- 2. (5 points) There is evidence of something called “sheepskin effect” – the increase in wages due to the last year of college is higher than the increase in wages due to third (or first, or second) year of college. In other words, people with four full-time years of college *and a degree* make more on average than people with four years of college *but no degree*. Is this phenomenon more consistent with human capital theory or screening theory? Explain.

**The “sheepskin effect” would be more consistent with screening theory. While two people with four years of college have (presumably) similar levels of human capital acquired in college, they get paid differently based on availability of a degree. This must mean that degree serves as a signal of higher ability/productivity (because the wages reflect productivity).**

- 3. (25 points) Social Security reform.
  - a. What is the difference between *pay-as-you-go* and *fully funded* social security systems? What is the reason that Social Security may be in trouble?

**Pay-as-you-go system taxes current generation of workers and pays current generation of retirees. Fully funded system taxes current generation of workers and saves the money to pay the same generation then they retire. The fundamental problem comes from the fact that SS system may become insolvent in some foreseeable future. Some forecasts say it will, some say it won't. The reason it may become insolvent is that the basic demographic structure of US society is changing in such a way that it becomes increasingly difficult to maintain the level of benefits to retirees keeping the system in its current form. The demographic changes we deal with here are lower birth rates and longer lives, both of which reduce the number of workers per one retiree.**

- b. Name at least three incremental reform proposals.

**The incremental reforms preserve the basic structure of the current SS system (i.e., leave it pay-as-you-go) and change details of the system:**

- (1) Raise payroll tax;**
- (2) Expand taxable wages (either by increasing the limit of taxable wages of existing enrollees and/or bringing more people into the system);**

- (3) Raise retirement age (essentially means lowering benefits);
- (4) Lower benefits;

c. Name at least two fundamental reform proposals and briefly discuss the problems associated with each.

**Fundamental reforms aim to change the system from pay-as-you-go to fully funded (at least in part):**

- (1) Invest the Trust Fund into stock market (instead of government bonds). Investing it in the government bonds essentially means giving it to the government to spend in the current year. Stock market offers much higher rate of return. The problems with this approach is that if it is impossible to keep politicians from spending the Trust Fund now, what is the guarantee that it would be possible to do in the future with even bigger fund (which would grow with stock market). Also, it puts too much power to influence stock market in politicians' hands.
- (2) Privatization – do the same (invest in the stock market); but people themselves will be managing their private accounts. The problem is that the current old generations still have to paid and to do so the payroll taxes have to be increased and/or government has to borrow even more (this problem also concerns the first type of reform proposal) and is the most important criticism of fundamental reform. The other problem particular to privatization is that administrative costs will rise drastically because of the need to manage private accounts.

d. Do you think that making Social Security voluntary would work?

**It most likely won't work. The rich people who have a lot less problems with financial planning on their own will want to leave the system because it redistributes income from rich to poor. Adverse selection may also play a role – people who don't expect to live long may not want to participate. In addition, many people will think that society will take care of them anyway if they're in trouble.**

4. (15 points) Consider a society with equal number of the three types of families X, Y and Z. These families have exactly the same incomes,  $I = \$300$  each. They maximize their utilities by choosing how much education  $E$  and all other goods  $OG$  to consume. All education is privately provided at a price  $P_E = \$3$ , the price of all other goods is  $P_{OG} = \$1$ . These families have different preferences: family X –  $U_X(E_X, OG_X) = E_X^{1/4} OG_X^{3/4}$ , family Y –  $U_Y(E_Y, OG_Y) = E_Y^{1/2} OG_Y^{1/2}$ , family Z –  $U_Z(E_Z, OG_Z) = E_Z^{3/4} OG_Z^{1/4}$ . Recall that for the utility function given by  $U(E, OG) = E^a OG^b$  (such that  $a+b=1$ ) the optimal consumption levels of education and all other goods are given by  $E^* = a*(I/P_E)$ , and  $OG^* = b*(I/P_{OG})$ .
- a. Name and briefly discuss at least three reasons for government involvement in the education.

- (1) Positive externalities (worker's own increased productivity is not an externality) – increase productivity of coworkers;
- (2) Educated becomes 'better citizens' – they're more likely to vote, for example;
- (3) Credit market failures (difficult to get a loan without collateral);
- (4) Redistribution of income;
- (5) Failure to maximize utility by parents.

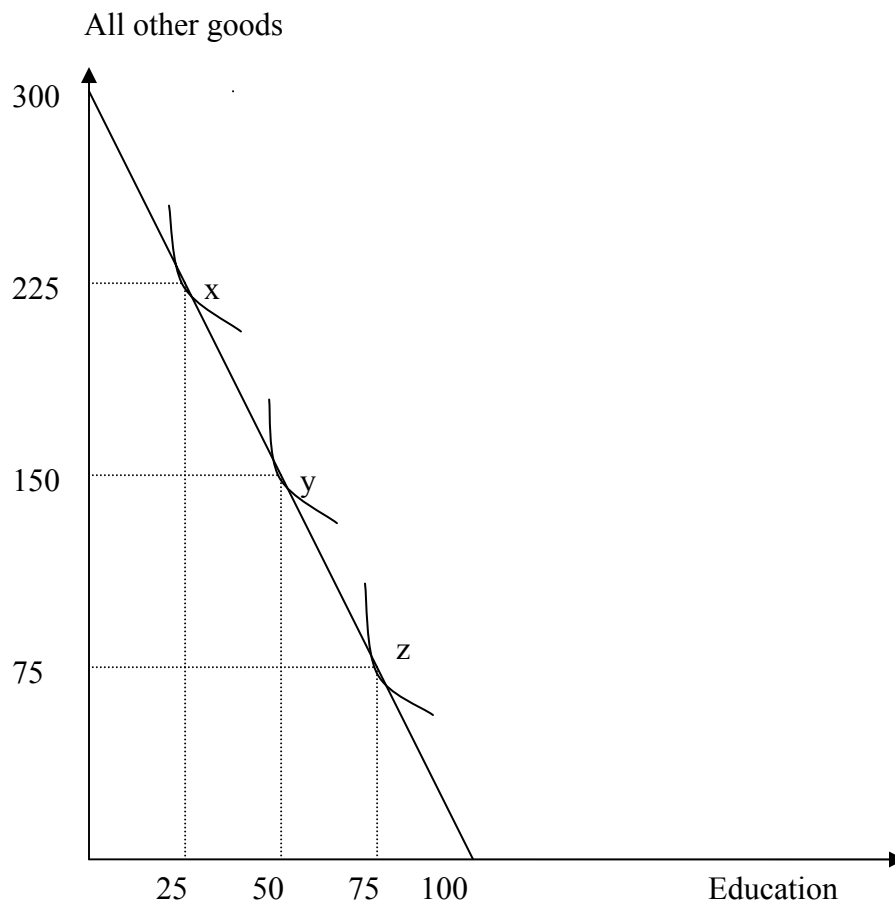
b. Graph the budget constraint (the same for all families). Determine how much education and all other goods each family will consume and label these points on your graph as x, y and z respectively.

The optimal allocations are given by:

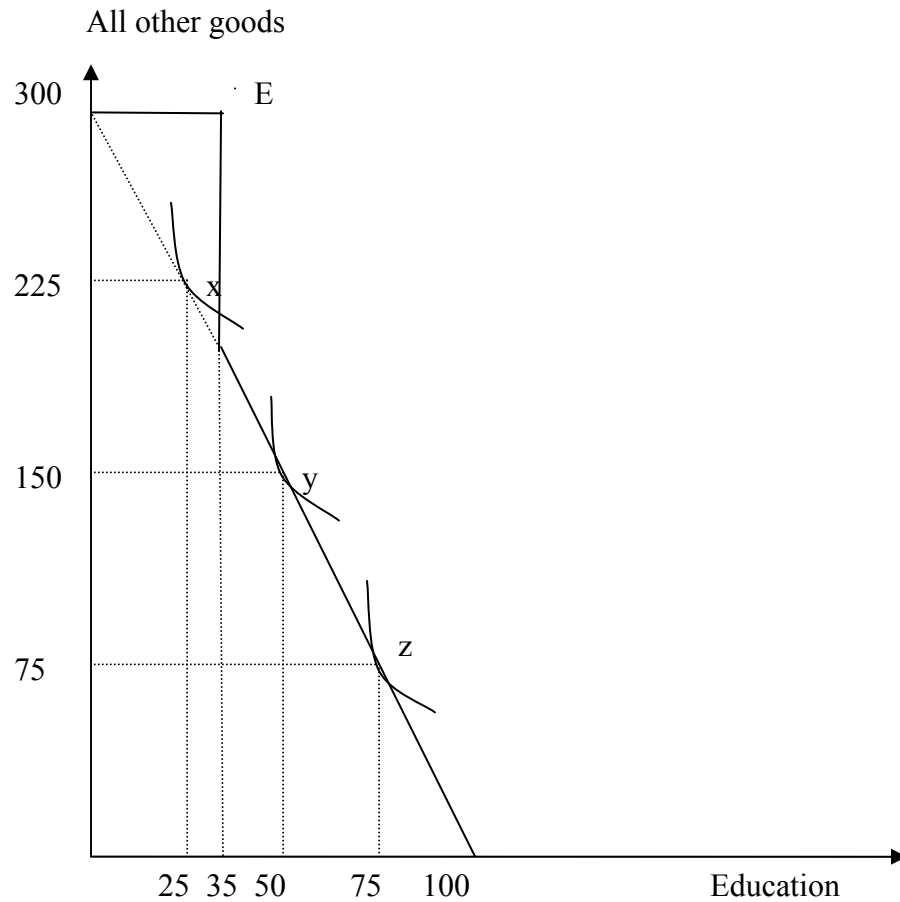
**X:**  $E^* = a \cdot (I/P_E) = (1/4) \cdot (300/3) = 25$ , and  $OG^* = b \cdot (I/P_{OG}) = (3/4) \cdot (300/1) = 225$ ,  
 $U_X = 25^{1/4} \cdot 225^{3/4} = 129.9$ .

**Y:**  $E^* = a \cdot (I/P_E) = (1/2) \cdot (300/3) = 50$ , and  $OG^* = b \cdot (I/P_{OG}) = (1/2) \cdot (300/1) = 150$ ,  
 $U_Y = 50^{1/2} \cdot 150^{1/2} = 86.6$ .

**Z:**  $E^* = a \cdot (I/P_E) = (3/4) \cdot (300/3) = 75$ , and  $OG^* = b \cdot (I/P_{OG}) = (1/4) \cdot (300/1) = 75$ ,  
 $U_Z = 75^{3/4} \cdot 75^{1/4} = 75$ .



- c. Now imagine that government introduces a public school system that provides 35 units of education for free to anyone who wishes it. It is a take-it-or-leave-it offer – it impossible to supplement education provided by government by privately purchased education. Plot a new budget constraint that all families face. For each family determine whether they would choose to enroll in public school. Is the total amount of educational spending in this country going to be higher or lower as a result?



Clearly, a family of any type will either choose to move to the point E on the graph (take up government provided education) or stay where they were. We just need to calculate the utilities associated with moving to point E (OG=300, E=35) for each family:

$$U_X = 35^{1/4} 300^{3/4} = 175.3 > 129.9 \text{ (take the offer).}$$

$$U_Y = 35^{1/2} 300^{1/2} = 102.5 > 86.6.$$

$$U_Z = 35^{3/4} 300^{1/4} = 59.9 < 75.$$

**That is, families X and Y will take up government-provided education. Families of type Z will stay put. The total spending on education will go down:  $145 (= 35 + 35 + 75) < 150 (= 25 + 50 + 75)$**

5. (20 points) Suppose that there are a large number of people in a country. These people have identical incomes and preferences (preferences display the property of risk-aversion). Suppose that all people are different with respect to their probability to get sick and require medical care (assume no two persons have the same probability) and that insurance companies have no way of differentiating among different risk types.

a. Explain how Adverse Selection can destroy health insurance market.

**Adverse selection exists because there is informational asymmetry between insurance company and individuals. Since there is no way for insurance company to differentiate between the many types of individuals, it offers the average premium to everyone. As a result, only worse than average risks select into insurance pool, while better than average risks select not to join. Insurance company suffers losses as a result and offers the average premium for those who are enrolled. Now large part of those enrolled (healthier on average) will find this new premium too high and will exit the market. The insurance will suffer losses and raise premium yet again. The process continues until the market doesn't exist – only the worst risks (people with worst health) are insured.**

b. Name at least two reasons why insurance market is not destroyed (at least not completely) in reality in US.

**(1) High degree of risk-aversion may prevent healthy people from leaving even if the premium is unfairly high for them, thus breaking the 'evil circle'.**

**(2) Majority of people in US get their health insurance through employers and there are large tax subsidies to buy health insurance this way. Compared to all other goods, people pay for insurance in pre-tax dollars, which means that government shoulders part of the bill.**

**(3) Again because of this predominant provision of insurance by employers, insurance companies are able to offer large discounts to large employers because these employers significantly reduce the risk for insurer by pooling large number of people.**

6. (10 points) Suppose that local government is contemplating a new irrigation project and contracted you to perform the cost-benefit analysis of this project. The project costs \$1000 now, and \$1000 next year, and \$1000 two years from now. The project will generate the gains in agricultural output from the irrigated lands, which amount to \$100 very year starting next year. In addition, the price of irrigated lands will go up by \$2000. The relevant interest rate is 5%. Should this project be undertaken? (hint: the infinite sum can be calculated as  $r+r^2+r^3+\dots=r/(1-r)$ ).

**The project should not be taken:**

**B=present value of discounted benefits=2000 (increase in the price of land) OR  
=  $100/(1+0.05)+100/(1+0.05)^2+\dots=100/0.05=2000$**

**C=  $1000+1000/(1+0.05)+1000/(1+0.05)^2=2859$ .**

**PV=B-C=2000-2859<0.**

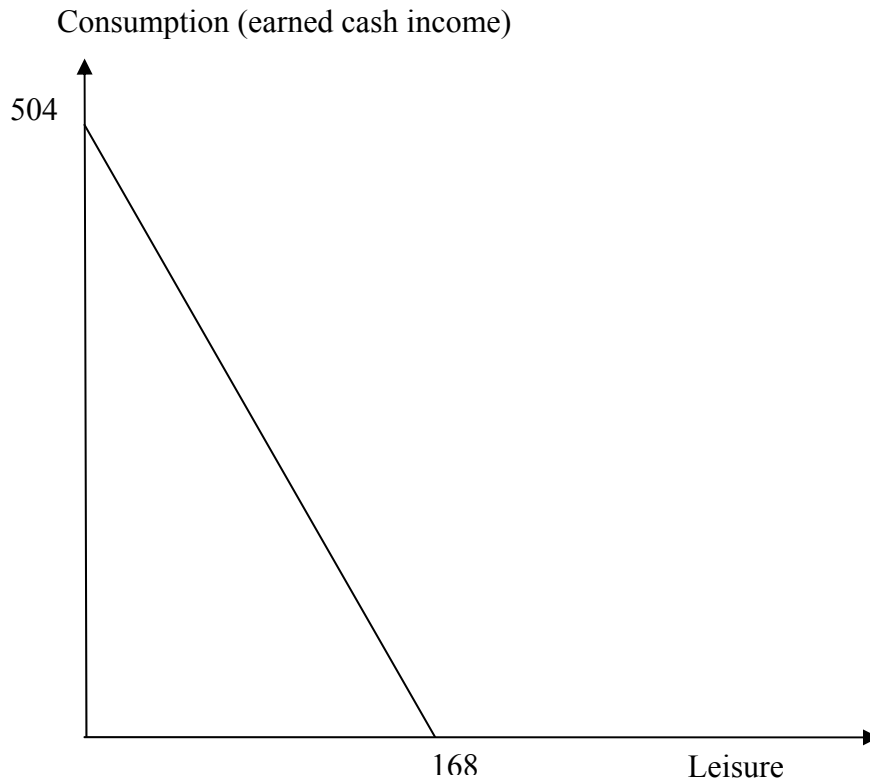
**The trick here is that in counting benefits we can either count the present value of the stream of benefits over time or just use the increase in the price of land.**

**Counting both will constitute double counting. The land prices increase exactly because of the stream of benefits coming from irrigation system. Moreover, the price increase exactly reflects the stream of the future benefits.**

7. (10 points) Dave is maximizing his utility by choosing how many hours to work a week. Dave's labor supply  $LS$  can be calculated by deducting his leisure consumption  $L$  from total number of hours available to him in a week:  $LS=7*24-L=168-L$ . His wage rate is \$3/hour.

- a. Sketch Dave's budget line. Make sure you label the axes and the points where the budget intersects axes. What is the slope of the budget line?

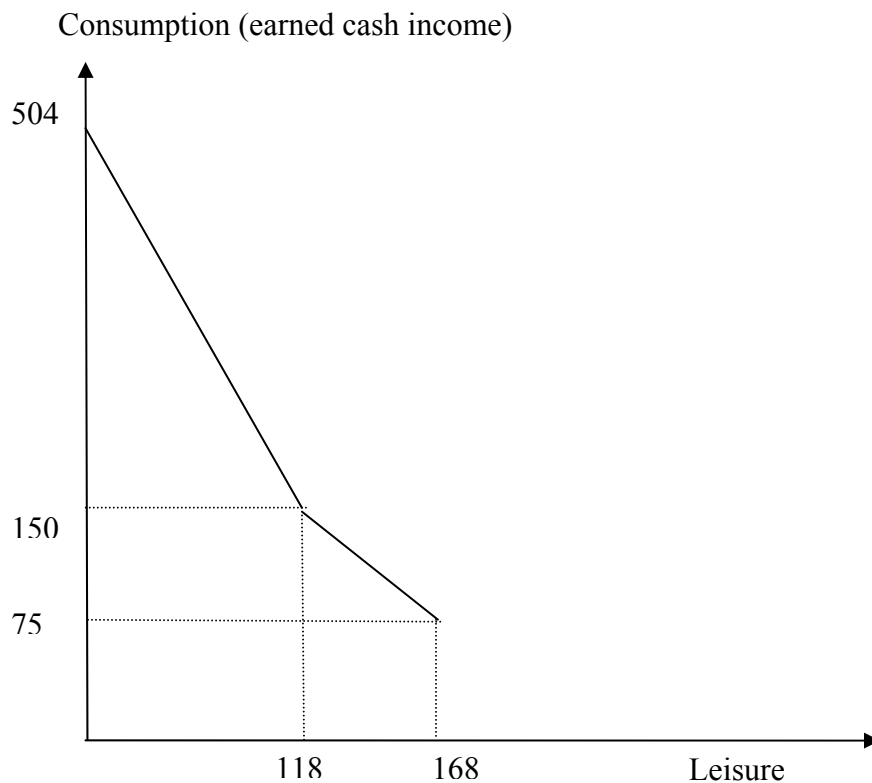
**The slope of the budget line is equal to the negative of the wage rate -3.**



- b. Now suppose that government introduces a welfare program, which has the following benefit level  $B=G-t*w*LS$ ; where  $B$  is the benefit level,  $G$  is

the basic grant equal to \$75,  $t$  is the benefit reduction rate equal to 0.5, and  $w$  is the wage rate, and  $LS$  is the labor supply. How many hours Dave has to work to reduce his benefit to zero and how much money would he earn in this case? What is the slope of the budget line? Sketch Dave's new budget, labeling all points.

**To reduce the benefit to zero, i.e.  $0=B=G-t*w*LS=75-1.5*LS$ , Dave has to work  $LS=50$ . This corresponds to the consumption level (earned cash income)  $C=50*3=\$150$  and leisure  $L=168-50=118$ . The slope of this new segment of the budget line is equal to negative wage net of tax  $-(1-t)w=-(1-0.5)3=-1.5$ .**



8. (extra credit 5 points) Suppose that Susan makes \$5 an hour. She is maximizing her utility by choosing how many hours to work a week (168 hours total available). Suppose also that government sets up a welfare program with a work requirement. In order to qualify for this welfare, Susan has to work at least 10 hours a week. After that her benefit follows a familiar schedule ( $B=G-t*w*(LS-10)$ ); where  $B$  is the benefit level,  $G$  is the basic grant equal to \$200,  $t$  is the benefit reduction rate equal to 0.25, and  $w$  is the wage rate, and  $LS$  is the labor supply). Draw Susan's budget constraint with and without this welfare program. Label everything.