Problem Set #9
PAI 723

Name: KEY

1) Public Goods.
   a. Define the concepts of rivalry and exclusion as they apply to goods, and use them to illustrate the difference between private and public goods.

A good is rival if consumption of a given unit of the good precludes another person from consuming that given unit. Exclusion means there is a feasible means of preventy access to the good, A public good is non-rival and has no exclusion. A private good is rival and has exclusion possible.

   b. Fill in the table. Which type of good from (b) goes where?

	Exclusion Possible	No Exclusion Possible
Rivalry	Private	Open Access
No Rivalry	Club	Public

   c. Discuss how and why derivation of the demand curve for public goods differs from the derivation of the demand curve for a private good.

For a private good, we horizontally sum quantities demanded by individuals at a given price (the means of exclusion) because the good is rival.

For a public good, we vertically sum the willingness to pay for a given unit of the good (because it is non rival) for all members of society (because there is no exclusion).

2) Two people live next door to each other on a bay, and are the only residents on the bay. During storms, high waves cause property damage on each person's property. By building a breakwater near the mouth of the bay, they can avoid this damage to their shoreline. The only place that it is feasible to build this breakwater will provide this protection to both properties. Dorothy owns one of the houses, and spends $13,000 repairing her property from the storm damage. Henry owns the other house, and spends $3,000 repairing his property. Building the breakwater costs $10,000. If they both agree to build it, they share the cost of building equally ($5,000 each).

a. Is the total benefit (as reflected in the benefit of not having to pay to repair storm damage) greater than the cost? You can assume both the damage repair costs and the building cost are in present value terms.

Repair: 13,000 + 3,000 = 16,000
Build Breakwater: 10,000
Benefit of not having to make repairs, 16,000
is greater than the cost of building the breakwater to prevent the damage that leads to repairs. Yes 16,000 > 10,000

b. Explain how the Nash Equilibrium outcome of this game illustrates the free rider problem in the provision of public goods.

		Dorothy	
Henry		Build	Don't Build
	Build	-$5,000 -$5,000	-$10,000 $0
	Don't Build	$0 -$10,000	-$3,000 -$13,000

H Build, D- DB
H Don't Build, 0-B
D Build, H - DB
D Don't Build, H - DB

NE is D Builds and gets -10,000 and H Does not build (free rides) and gets 0 compared to -3000

c. Does the free rider problem in this example lead to an inefficient outcome?

No, we get to the efficient outcome at the nash equilibrium because it is built. It is not fair perhaps, but it is efficient

3) Public goods, voting, and benefit cost.
Jordan Elbridge High School is trying to decide what physical plant improvements to make to the High School Property. There are five families in the school district who will vote on the improvements. They are confronted with three proposals:

Proposal A: Replace wastewater treatment plant, connect to municipal sewage system, and replace and improve drainage system. Total cost is $3,000 ($600 each).

Proposal B: All of what is in proposal A plus a new artificial turf playing field surrounded by an all season track. Total cost is $10,000 ($2,000 each).

Proposal C: All of what is in proposal B plus heated locker rooms and stadium rest rooms. Total cost is $20,000 ($4,000 each)

This table records each household's WTP for each proposal.

	Proposal A 600	Proposal B 2000	Proposal C 4000
Taylor	$1,000	$1,800	$3,500
Feeney	$500	$3,500	$3,500
Badger	$500	$1,800	$9,500
Bennett	$1,600	$1,900	$3,000
McPeak	$700	$1,500	$3,500

a) Each household gets one yes vote. If they have WTP greater than cost for more than one proposal, they will give their yes vote to the proposal that has the greater difference between WTP and cost to that household. How will they vote? (circle)

	Proposal A		Proposal B		Proposal C	
Taylor	(Yes)	No	Yes	(No)	Yes	(No)
Feeney	Yes	(No)	(Yes)	No	Yes	(No)
Badger	Yes	(No)	Yes	(No)	(Yes)	No
Bennett	(Yes)	No	Yes	(No)	Yes	(No)
McPeak	(Yes)	No	Yes	(No)	Yes	(No)
	PASS		NOT PASS		NOT PASS	

b) If the costs are present value costs, and the willingness to pay figures are present value benefits, what is the net present value of each proposal?

Proposal A	Proposal B	Proposal C
4,300 − 3000 = 1,300	10,500 − 10,000 = 500	23,000 − 20,000 = 3,000

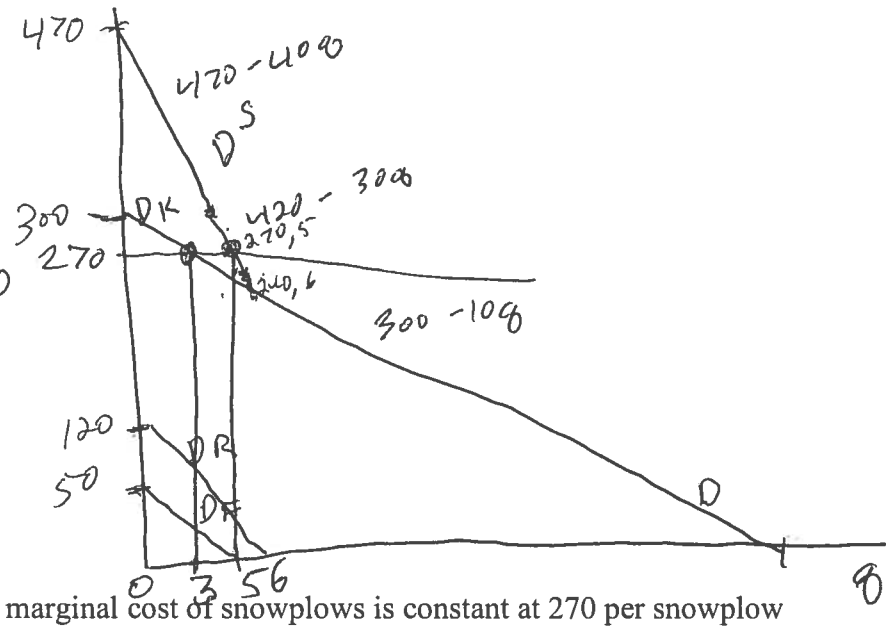
c) Did voting lead us to select the proposal that had the highest net present value? Explain why or why not.
No. The highest NPV is proposal C but we selected proposal A. Badger has a very strong preference for Proposal C, but yes/no voting ignores the intensity of preferences. The valuation of the median voter determines the outcome: McPeak is median voter for A, Badger/Taylor is median on B, and Taylor/Feeney/McPeak is median on C.

4) Public goods. There are three people who live in a town. They each have a demand curve for the number of snowplows (q is the # of snowplows here) that will keep the streets clear in the winter. Frosty has a willingness to pay for the number of snowplows defined by 50-10*q. Rudolph has a willingness to pay for the number of snowplows defined by 120-20*q. Kris has a willingness to pay for the number of snowplows defined by 300-10*q.

a. Draw these individual demand curves and the societal demand curve for this public good.

Frosty WTP = 0 at 5
Rudolph WTP = 0 at 6
Kris WTP = 0 at 30

$470 - 40q$ 0 to 5
$420 - 30q$ 5 to 6
$300 - 10q$ 6 to 30
0 more than 30



b. If the marginal cost of snowplows is constant at 270 per snowplow and no effort is made to avoid the free rider problem, what number of snowplows will be provided and who will provide it?

Kris will provide 3.

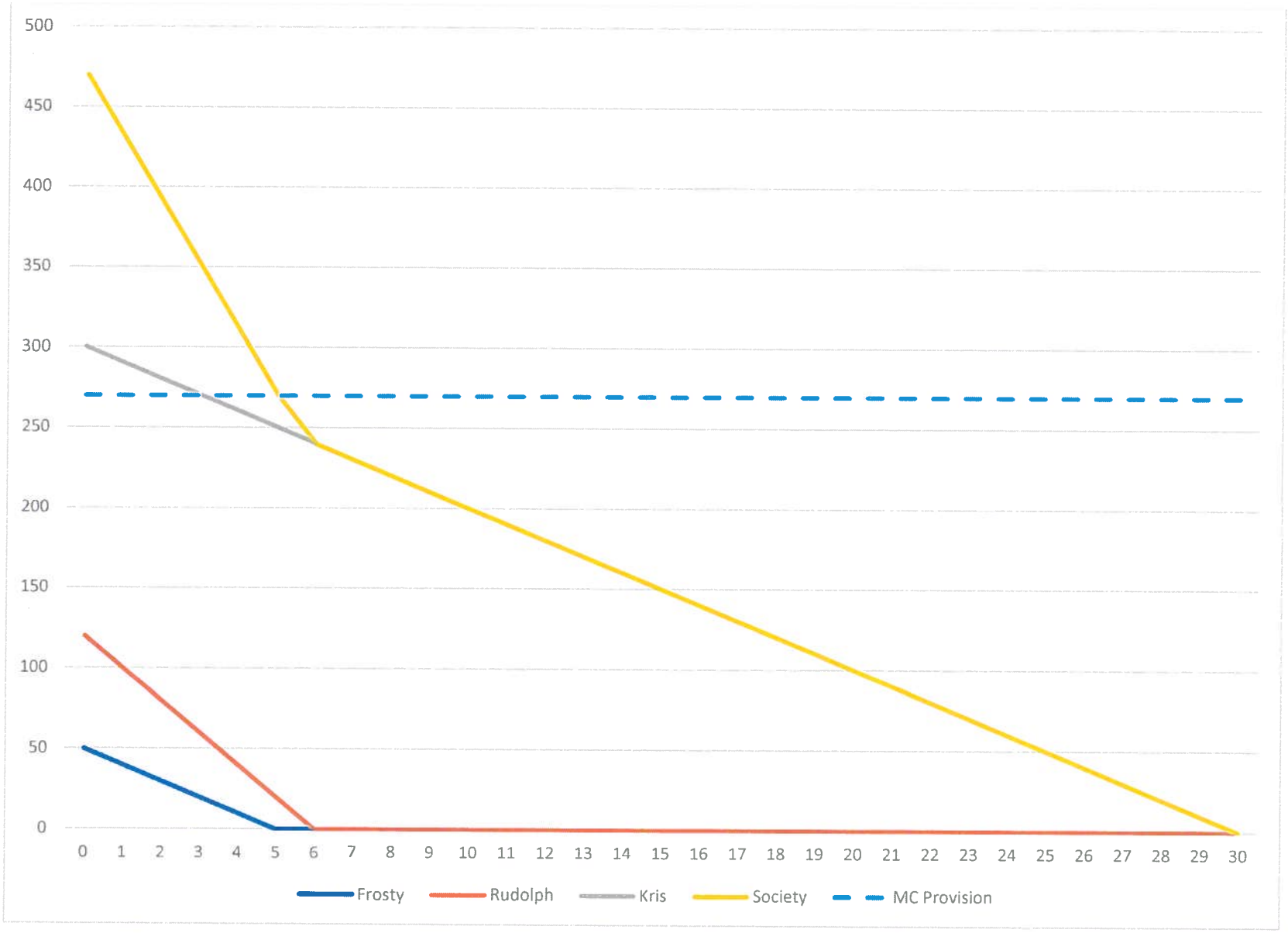
$300 - 10q = 270$ at $q = 3$

c. How much less is this than the socially optimal number of snowplows if the cost is 270 per snowplow?

$470 - 40q = 270$
$200 = 40q$, $q = 5$

$420 - 30q = 270$
$150 = 30q$, $q = 5$

This is 2 less than the socially optimal amount, which is $q = 5$.


500
450
400
350
300
250
200
150
100
50
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Frosty
Rudolph
Kris
Society
MC Provision