Hunters in the Republic of Guinea have been placing increasing pressure on wildlife numbers. Recent research indicates that most of them understand that current practices are unsustainable, and that this is also the assessment of the government. Three alternatives are being considered to confront this situation. Assume r=10%.

Option A: Maintain the current policy and practices. Currently the government is spending 2 million USD per year on enforcement, and this will be the case for the current year (t=0), next year (t=1), the year after (t=2) and the last year (t=3). The value of the meat hunters get from hunting in the current year (t=0) is 3 million, next year (t=1) will be 1 million, the year after (t=2) will be a half million, and the final year, when the wildlife populations have become extinct due to hunting, the value of meat will be zero since there are no animals left to hunt.

	Benefit	Cost
T=0	3	2
T=1	$1/(1.1)$	$2/(1.1)$
T=2	$0.5/(1.1)^2$	$2/(1.1)^2$
T=3	$0/(1.1)^3$	$2/(1.1)^3$
TOTAL	4.32	6.97

NPV=-2.65

Option B: Hunters maintain that they are driven by poverty to hunt. If they had an alternative way of making money, many would stop hunting. An NGO is proposing a goat raising project in this area. It will cost 6 million dollars in the current year (t=0) to start this project, and 1.5 million in each of the following three years (t=1, t=2, t=3) to run. After year t=3 the project will end. The foregone benefits of hunting during this period can be treated as a present value cost of 2 million. Benefits have been calculated in present value terms by the project team and are stated as equaling 12 million. This is the PV of 3 million for the discounted new benefits from the goat project over all periods in the future, and 9 million for the discounted benefits of bushmeat hunting over all periods in the future under the assumption that it will become sustainable with fewer hunters participating if the goat raising project succeeds.

	Benefit	Cost
T=0	9+3	6+2
T=1		$1.5/(1.1)$
T=2		$1.5/(1.1)^2$
T=3		$1.5/(1.1)^3$
TOTAL	12	11.73

NPV=0.27

Option C: Crackdown on enforcement. Increase spending on enforcement to 3 million for each of the years (t=0, t=1, t=2, t=3). This is expected to cause the value of meat from hunting to be zero over these years. After populations build up, hunting will again be allowed, but at a controlled level that will be sustainable over time. As before, there is a foregone benefit of 2 million in present value if this policy is adopted, and it is estimated that the present value of benefits from hunting after wildlife populations recover is 9 million in present value terms.

	Benefit	Cost
T=0	9	2+3
T=1		$3/(1.1)$
T=2		$3/(1.1)^2$
T=3		$3/(1.1)^3$
TOTAL	9	12.46

NPV=-3.46

Benefit cost.

Poverty reduction is a major goal of international development agencies. Currently, two strategies are being considered in a country called Landlockia. Both are currently estimated to lead to a 5% reduction in poverty at the end of four year period. The four years are an initial year (t=0) and three years of operation (t=1, t=2, t=3). We will only be able to select one of these strategies. The discount rate is 10%.

Scenario A: Land reform. We will need 14 million USD to pay compensation to the large landholders in year zero. This land will be redistributed to the landless. The formerly landless will need training and support in farming that will cost 3 million per year in each year (t=1, t=2, t=3). It is anticipated that in each of the years t=0 and t=1 the value of agricultural sector production will be 2 million less than it would have in the absence of land reform, while in t=2 and t=3 each it will be 2 million greater than it would have been in the absence of land reform and training. The present value of the increased agricultural production that will result from the land reform program in years beyond t=3 is estimated to be 26 million.

Scenario B: Construct an international airport and develop a flower export sector with the existing distribution of land ownership. If we build an airport, cargo planes will be able to transport our flowers overnight for sale in Holland. It will cost us 7 million dollars in year zero and 1 million per year in each year (t=1,t=2,t=3) to build the airport. It will also cost us 4 million in each of the three years (t=1,t=2,t=3) to develop our flower export industry. Present value benefit of the new flower export industry that will be operational as a result of this project after t=3 is estimated to be 30 million. Present value cost of operating the airport after t=3 are estimated to be 5 million.

a) Calculate Net Present Value for Scenario A.

b) Calculate Net Present Value for Scenario B.

c) Which project should be picked and why?

6) Public goods.

a. Every summer, a play is performed in an open air theater in a public park. No admission fee is charged. We are trying to determine the optimal number of days to perform the play. In this case, q is the number of days the play will be performed / number of performances (the play is only performed once per day). There are three people who make up society in this case; Hortensio, Ophelia, and Yorick. Hortensio's demand curve for the number of days the play will be performed is defined by 1100-100*q, Ophelia's is 500-50*q, and Yorick's is 400-50*q. What is total marginal willingness to pay on the societal demand curve for the provision of the fifth day/ performance of the play? (show how you got this answer)

b. If it costs 1000 to put on a performance, and no effort is made to avoid the free rider problem, what number of days will the play be performed and who will provide it?

14) Two adjacent states, call them state A and state B, have the river that runs between them as their main source of water. Each is currently deciding how much water should be taken from the river and treated to be used in the domestic water supply in the coming month. For each state, the control for the pipe that draws the water from the river has three settings; low, medium, and high. The more total water is taken out, the lower the water level drops, which can reduce the flow of the water into the respective pipes. Each cell in the table describes the amount of water each state will draw from the river in cubic meters when each state selects the pipe control setting described.

	State B			
State A		Low	Medium	High
	Low	50,000 50,000	45,000 100,000	40,000 110,000
	Medium	100,000 45,000	80,000 80,000	60,000 85,000
	High	110,000 40,000	85,000 60,000	70,000 70,000

a) Describe the full set of best response strategies for each state.

b) What is the Nash Equilibrium outcome of this game?

c) Is there a negative externality imposed by one decision maker on another in this game? If so, how do you know there is one? / If not, how do you know there is not one?