

Exercise 2

Name:

INR 3303: Foreign Policymaking

Due: Thurs., Sept. 15, 2005

1. What is the expected utility of buying a lottery ticket that costs \$1 if the odds of winning are 1 in 20,000,000 and the jackpot is \$25,000,000? Show your work.

$$E(u) =$$

2. What is the expected utility of playing a game in which you get \$100 if you win and pay \$20 if you lose, assuming the odds of winning are 25%? Show your work.

$$E(u) =$$

3. Graham Allison is among those who use utility analysis to explain US weapons acquisition decisions. Consider the following problem. Suppose that you are the Assistant Secretary of Defense for Program Analysis and Evaluation (Air Forces Division). You are considering the following two acquisitions proposals:

- a. AIM/RIM-7R Sparrow Missile: \$100,000 each ($M = 2$)
b. AIM-9X Sidewinder Missile: \$80,000 each ($M = 3$)

Let us assume that the value of a missile has two components: (a) its cost, and (b) its "effectiveness." Suppose that **effectiveness** = $C \times M$, where C is the cost and M is an "effectiveness multiplier." The bigger the multiplier, the more effective the missile per dollar. The value of a missile, then, is equal to effectiveness minus cost. Which has the greater total **value**: 5 Sparrow missiles or 5 Sidewinder missiles? Show your work.

$$E(u)_{\text{Sparrow}} =$$

$$E(u)_{\text{Sidewinder}} =$$

Which has the greater total value?

4. Keeping the information in problem 3 in mind, suppose Raytheon (which makes Sparrow missiles) proposes a missile development program based on a new and unproven technology. Raytheon would like the government (**you**, in this case) to pay \$10 million up front to develop a new missile (the "Sparrow II"). If the technology works, the Sparrow II will cost \$200,000 but its effectiveness multiplier (M) will be 3, just like the Sidewinder. There is a 25% chance the new missile will not work, however, in which case $M = 0$. Would it be better to buy 100 Sparrow missiles now, or would it be better to invest in the new missile and buy 100 Sparrow IIs later (you will only know whether they work **after** you buy and test them)? Show the expected utility equations that support your answer (use the back of the page if needed).