ECN 106 : Decision Making Professor Giacomo Bonanno

WINTER 2024 - SECOND MIDTERM EXAM: ANSWERS for VERSION 2

1. **(a)** Putting the money in the checking account corresponds to the lottery $\begin{pmatrix} \$1,500 \\ 1 \end{pmatrix}$, whose expected value is 1,500, while putting it in the mutual fund corresponds to the lottery $\begin{pmatrix} \$2,000 & \$1,700 & \$1,100 \\ \frac{8}{100} & \frac{74}{100} & \frac{18}{100} \end{pmatrix}$ whose expected value is 1,616. Hence Jimmy would be risk averse.

(b) The possible levels of wealth are: \$2,000, \$1,700, \$1,500 and \$1,100. Assign utility 1 to \$2,000 and zero to \$1,100. Since $\underbrace{\begin{pmatrix} \$1,700 \\ 1 \end{pmatrix}}_{CD} \sim \underbrace{\begin{pmatrix} \$2,000 & \$1,100 \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}}_{startup}$ the utility of \$1,700 is $\frac{1}{2}1+\frac{1}{2}0=\frac{1}{2}=0.5$. Finally, since $\underbrace{\begin{pmatrix} \$1,500 \\ 1 \end{pmatrix}}_{Checking} \sim \underbrace{\begin{pmatrix} \$1,700 & \$1,100 \\ \frac{92}{100} & \frac{8}{100} \end{pmatrix}}_{foreign\ venture}$, the utility of \$1,500 is $\frac{92}{100}0.5+\frac{8}{100}0=0.46$. Hence Jimmy's utility function is $\begin{matrix} \$2,000 & \$1,700 & \$1,500 & \$1,100 \\ 1 & 0.5 & 0.46 & 0 \end{matrix}$.

(c) $\mathbb{E}[U(checking)]=0.46$, $\mathbb{E}[U(mutual)]=\frac{8}{100}1+\frac{74}{100}0.5+\frac{18}{100}0=0.45$ $\mathbb{E}[U(CD)]=0.5$, $\mathbb{E}[U(startup)]=0.5(1)+0.5(0)=0.5$, $\mathbb{E}[U(foreign)]=\frac{92}{100}0.5+\frac{8}{100}0=0.46$.

(d) For a risk neutral person we compute expected values. $\mathbb{E}[checking]=1,500$, $\mathbb{E}[mutual]=\frac{8}{100}2,000+\frac{74}{100}1,700+\frac{18}{100}1,100=1,616$, $\mathbb{E}[CD]=1,700$, $\mathbb{E}[startup]=0.5(2,000)+0.5(1,100)=1,550$, $\mathbb{E}[foreign]=\frac{92}{100}1,700+\frac{8}{100}1,100=1,652.$ Thus the ranking is $CD \succ foreign \succ mutual \succ startup \succ checking$.

2. **(a)** First we need to convert outcomes into utilities:

	s_1	s_2	s_3	s_4
a	16	36	16	81
b	25	169	9	64
c	121	1	100	0

. Thus the regret table is:

	s_1	s_2	s_3	s_4
a	105	**[133]**	84	0
b	**[96]**	0	91	17
c	0	**[168]**	0	81

where the maximum regret for each act is highlighted.

(b) The MinMax Regret solution is: b.

(c) **(c.1)** $H(a,\frac{2}{5})=16\times\frac{2}{5}+81\times\frac{3}{5}=55$. **(c.2)** $H(b,\frac{2}{5})=9\times\frac{2}{5}+169\times\frac{3}{5}=105$.
(c.1) $H(c,\frac{2}{5})=0\times\frac{2}{5}+121\times\frac{3}{5}=\frac{363}{5}=72.6$.

(d) $\mathbb{E}[U(a)] = \frac{16+36+16+81}{4} = \frac{149}{4}$, $\mathbb{E}[U(b)] = \frac{25+169+9+64}{4} = \frac{267}{4}$,

$\mathbb{E}[U(c)] = \frac{121+1+100+0}{4} = \frac{222}{4}$ **.** Thus the act that maximizes expected utility is *b*.

3. **(a)** The information is (1) $P(D) = 0.06$ (from which we deduce that $P(\neg D) = 0.94$), (2) $P(-\mid D) = 0.01$ (from which we deduce that $P(+\mid D) = 0.99$**)** and (3) $P(+\mid \neg D) = 0.05$. Now, $P(+) = P(+\mid D)P(D) + P(+\mid \neg D)P(\neg D) =$ 0.99 (0.06) + 0.05 (0.94) = 0.1064 = 10.64%.

(b) 6% of 5,000 is 300; thus 300 have the disease and 4,700 don't. Of the 300 who have the disease, 1%, that is, 3 give a negative result; thus the remaining 297 give a positive result. Of the 4,700 who don't have the disease, 5% (that is, 235) give a positive result. Thus the table is as follows:

	positive blood test	negative blood test	Total
have the disease	297	3	300
don't have the disease	235	4,465	4,700
Total	532	4,468	

(c) $\frac{297}{532} = 0.5583 = 55.83\%$.