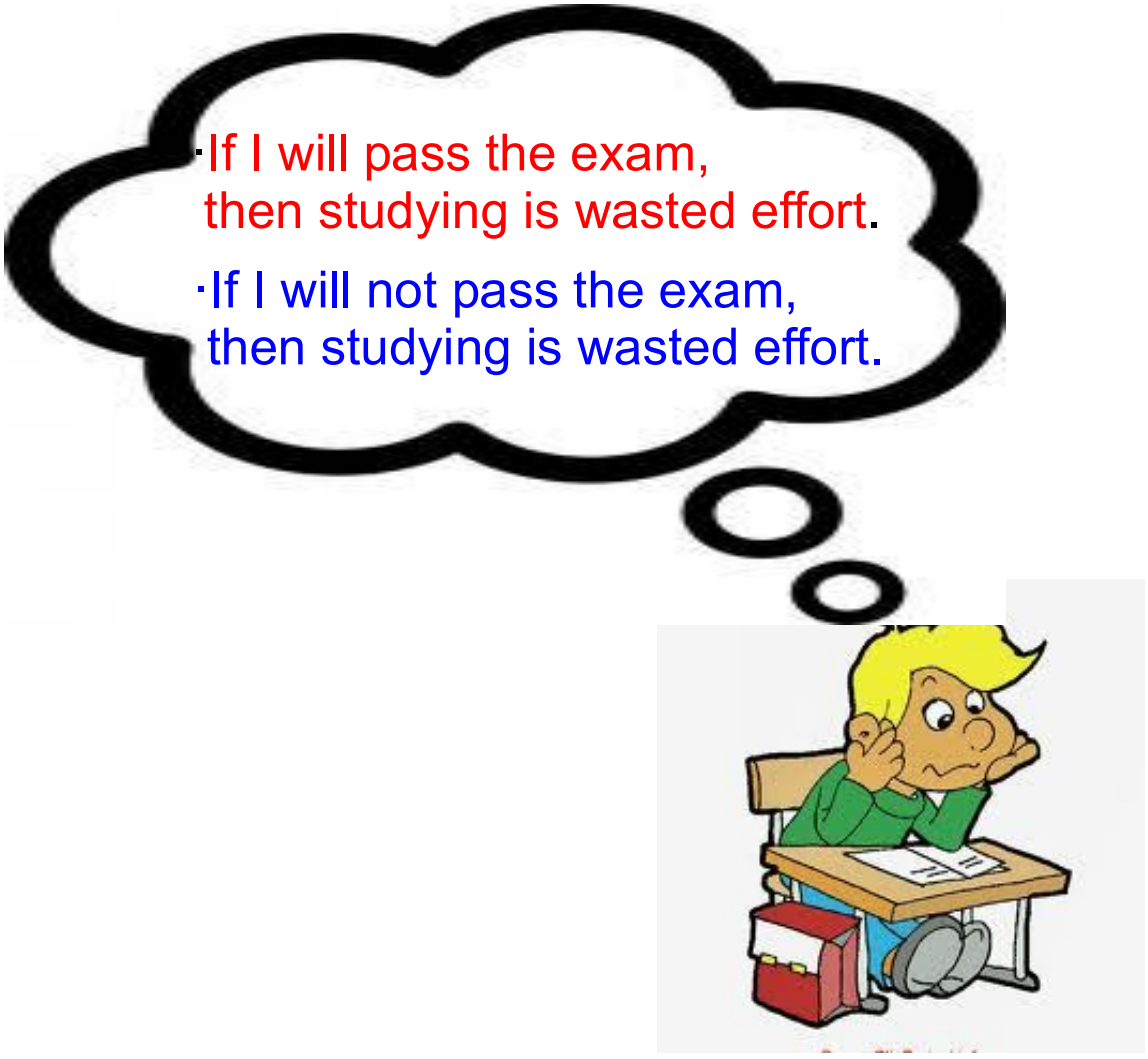
1. How to think about choices



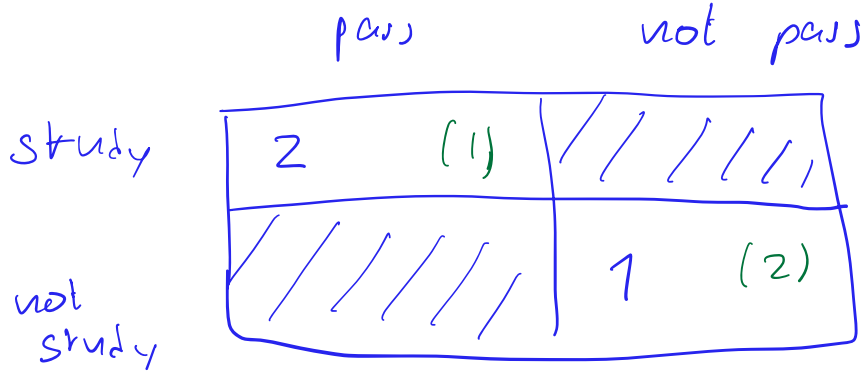
Since, whatever will happen, studying is wasted effort,
it is better for me **not** to study.

not study

not study

possible states

possible choices	Pass	Not pass
Study	2 (1)	0 (worst)
Not study	3 (best)	1 (2)



study

study

possible states

possible choices or acts	Exam is long and difficult	Exam short and easy
Study	C	A
Not study	F	C

2. What does 'Rationality' mean?

Harold Egbert Camping, president of Family Radio 1958-2011, predicted that the Rapture (the taking up into heaven of God's elect people) would take place on May 21, 2011 at 6pm.

Some followers of Camping gave up their jobs, sold their homes and spent large sums promoting Camping's claims.

Did these people act irrationally?

Weak definition: what you do is best given your beliefs

Strong definition: questions the beliefs

Bob smokes two packets of cigarettes a day. When asked if he would still smoke if he knew that he was going to get lung cancer from smoking, he says "No". When asked if he is worried about getting lung cancer, he says that he is not and explains that his grandfather was a heavy smoker all his life and died at the age of 98. He also explains that he read an article stating that smoking causes lung cancer only if one has a genetic predisposition to it.

	0%	100%
state →	s_1 : genetically	s_2 : no genetic
act ↓	predisposed	predisposition
smoke	get cancer enjoy smoking	no cancer enjoy smoking
not smoke	no cancer no enjoyment	no cancer no enjoyment

3. Framing

GAINS

I will give you $200:


and then you will have to choose one of:

OPTION A : I give you an additional $100:

75%

HEADS: I give you an additional $200


25%

OPTION B : I toss a coin

TAILS: I give you no additional money

risk averse towards gains

I will give you $400:

LOSSES

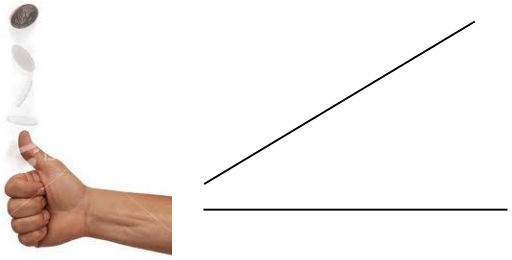
and then you will have to choose one of:

OPTION 1 : **You give me back $100**:

25%

75%

OPTION 2 : I toss a coin

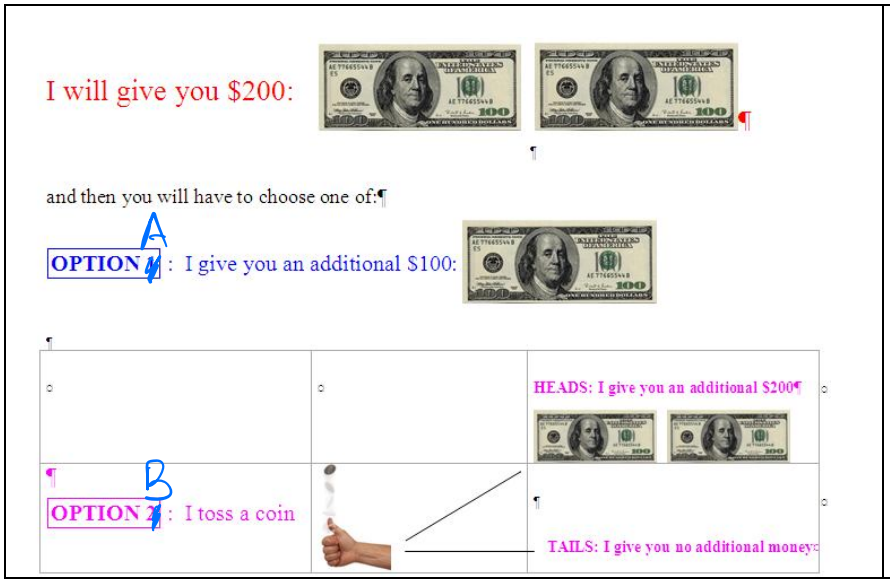


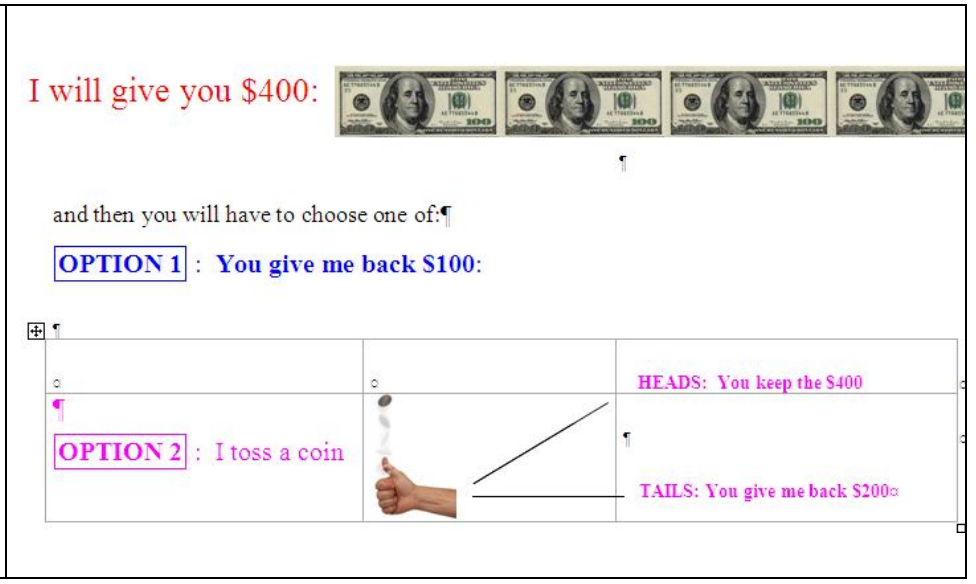
HEADS: You keep the $400

TAILS: You give me back $200

risk loving towards losses

Put the first and third problems side by side:





In both cases:

Option 1 = you end up with $300

Option 2 = you face the uncertain prospect (lottery)

$$\left(\begin{array}{c|c} \text{You end up with \$400} & \text{You end up with \$200} \\ \text{Probability } \frac{1}{2} & \text{Probability } \frac{1}{2} \end{array}\right)$$

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.

GAINS

- If **Program A** is adopted, 20,000 people will be saved. 75%
- If **Program B** is adopted, there is a $\frac{1}{3}$ probability that **all** 60,000 people will be **saved** and a $\frac{2}{3}$ probability that **none** of the 60,000 will be **saved**.

25%

Which of the two programs would you favor?

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed.

LOSSES

- If **Program C** is adopted, 40,000 people will **die**. 25%

- If **Program D** is adopted, there is a $\frac{1}{3}$ probability that **none** of the 60,000 will **die** and a $\frac{2}{3}$ probability that **all** of the 60,000 people will **die**. 75%

Put the second and fourth problems side by side:

Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed. • If **Program A** is adopted, 20,000 people will be saved. • If **Program B** is adopted, there is a $\frac{1}{3}$ probability that **all** 60,000 people will be **saved** and a $\frac{2}{3}$ probability that **none** of the 60,000 will be **saved**.	Imagine that the US is preparing for the outbreak of an unusual Asian disease, which is expected to kill 60,000 people. Two alternative programs to combat the disease have been proposed. • If **Program C** is adopted, 40,000 people will **die**. • If **Program D** is adopted, there is a $\frac{1}{3}$ probability that **none** of the 60,000 will **die** and a $\frac{2}{3}$ probability that **all** of the 60,000 people will **die**.

The two problems are the same. In both cases,

if Program A/C is adopted, 20,000 people are saved and 40,000 die;

Program B/D corresponds to the following lottery $\left(\begin{array}{c|c} \text{all 60,000 are saved} & \text{nobody is saved} \\ = \text{nobody dies} & = \text{all 60,000 die} \\ \text{Probability } \frac{1}{3} & \text{Probability } \frac{2}{3} \end{array}\right)$.

4. How to process information

- In the US, **1% of women of age 40 have breast cancer**.
- If a woman **has** breast cancer, the probability that she tests **positive** on a screening mammogram is **90%**.
- If she **does not have** breast cancer, the probability that she tests **negative** on a screening mammogram is **90%**.

That is, mammograms have a **90% accuracy**.

Susan is a 40-year old woman who tested **positive** *on a mammogram.*

What are the chances that she actually has breast cancer?

Most people say $\simeq 90\%$ BUT correct answer is $\approx 8\%$

Recommended viewing:

1. Dan Ariely, Are we in control of our own decisions?, on Ted.com:

   http://www.ted.com/talks/view/lang/en//id/548

2. Dan Gilbert, Why we make bad decisions, on Ted.com:

   http://www.ted.com/talks/lang/en/dan_gilbert_researches_happiness.html