

DECISION TREES

Decision to buy a house

- **NEW** (built 2015), costs \$350,000
- **OLD** (built 1980), costs \$300,000

You worry about the **total cost over the next 5 years**.

- **New** houses have a 25% probability of requiring a repair within 5 years and, on average, the repair would cost \$20,000.
- **Old** houses have a 60% probability of requiring a repair within 5 years and, on average, the repair would cost \$100,000.

Your options are: (1) buy house **N**, (2) buy house **O** or (3) pay \$1,000 to an **inspector** to inspect both houses. The inspector will be able to tell you if each house is good or bad.

- A **good new** house has probability 20% of requiring a repair (that costs \$20,000) and probability 80% of requiring no repair.
- A **bad new** house has probability 30% of requiring a repair (that costs \$20,000) and probability 70% of requiring no repair.
- A **good old** house has probability 50% of requiring a repair (that costs \$100,000) and probability 50% of requiring no repair.
- A **bad old** house has probability 70% of requiring a repair (that costs \$100,000) and probability 30% of requiring no repair.

Based on past data, the probabilities that the inspector will come up with the various verdicts are:

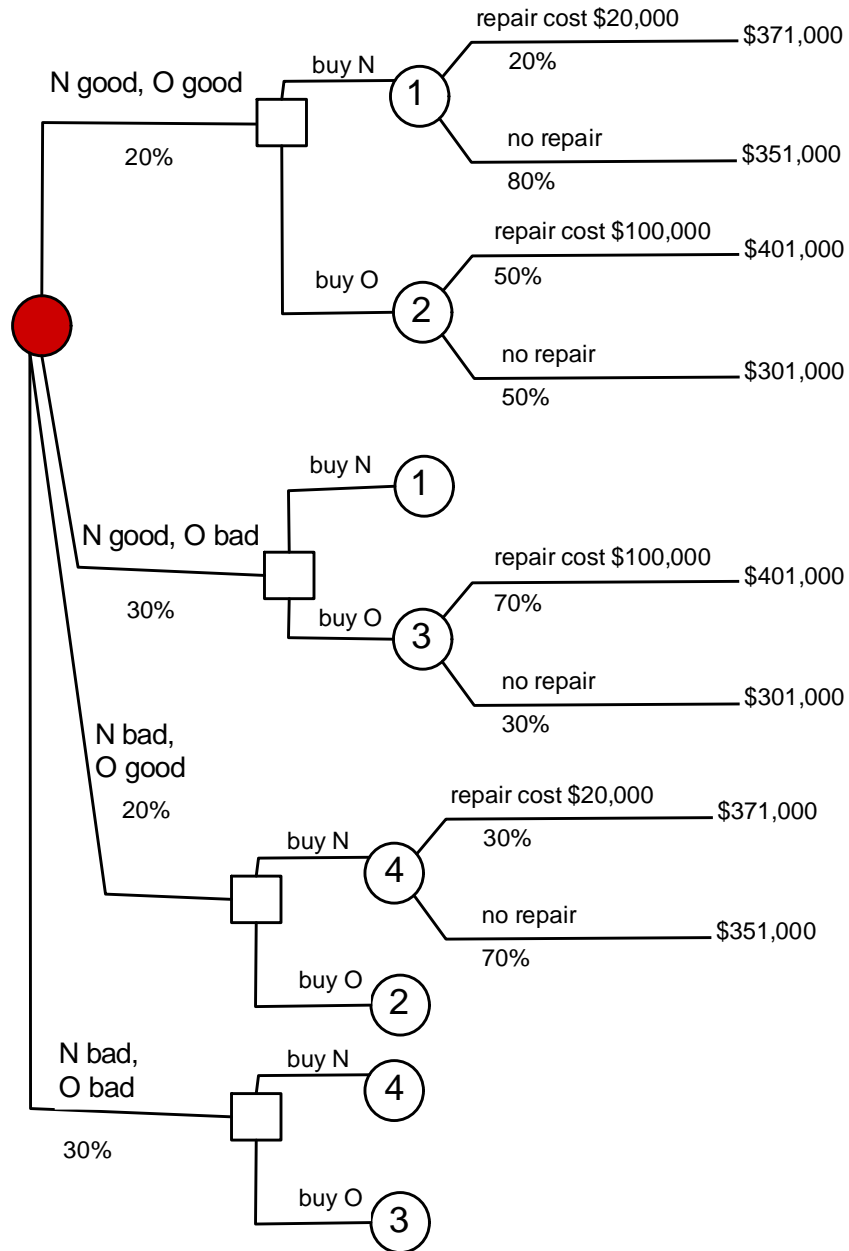
- Both good: 20%
- Both bad: 30%
- Old house good, new house bad: 20%
- Old house bad, new house good: 30%.

THIS IS A LOT OF INFORMATION!

- **NEW** costs \$350,000. **New** houses have a 25% probability of requiring a repair within 5 years and, on average, the repair would cost \$20,000.
- **OLD** costs \$300,000. **Old** houses have a 60% probability of requiring a repair within 5 years and, on average, the repair would cost \$100,000.
- You can also hire an inspector and pay her \$1,000

Assuming risk neutrality

The “hire inspector” module is as follows:

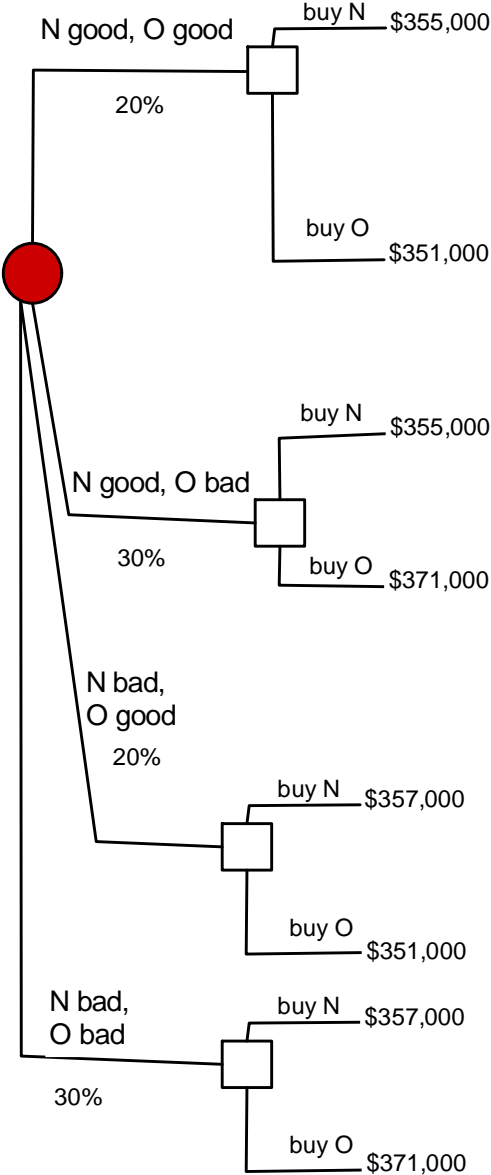


The expected values of the lotteries are:

- For ①:
- For ②:
- For ③:
- For ④:

Thus we can reduce this part of the tree to:

OBJECTIVE: pay the LOWEST 5-year cost



Thus we can reduce the option of hiring the inspector to the following lottery:

Whose expected value is

The optimal decision is:

1. hire the inspector and then

2. (a) if both good, buy

(b) if N good and O bad, buy

(c) if N bad and O good, buy

(d) if both bad, buy