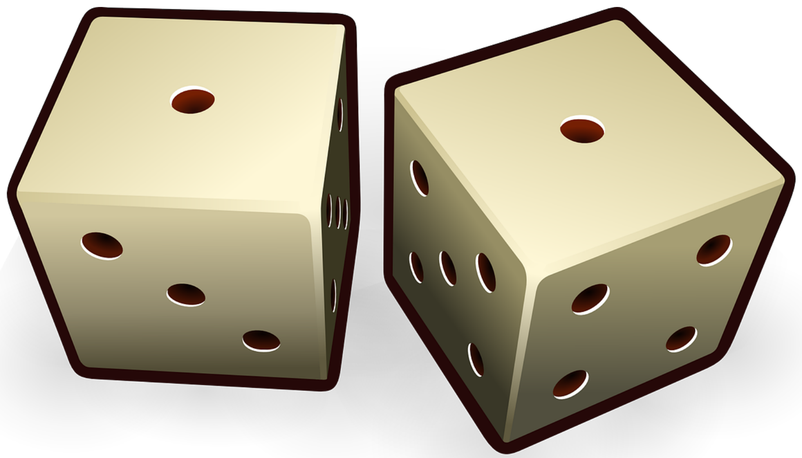


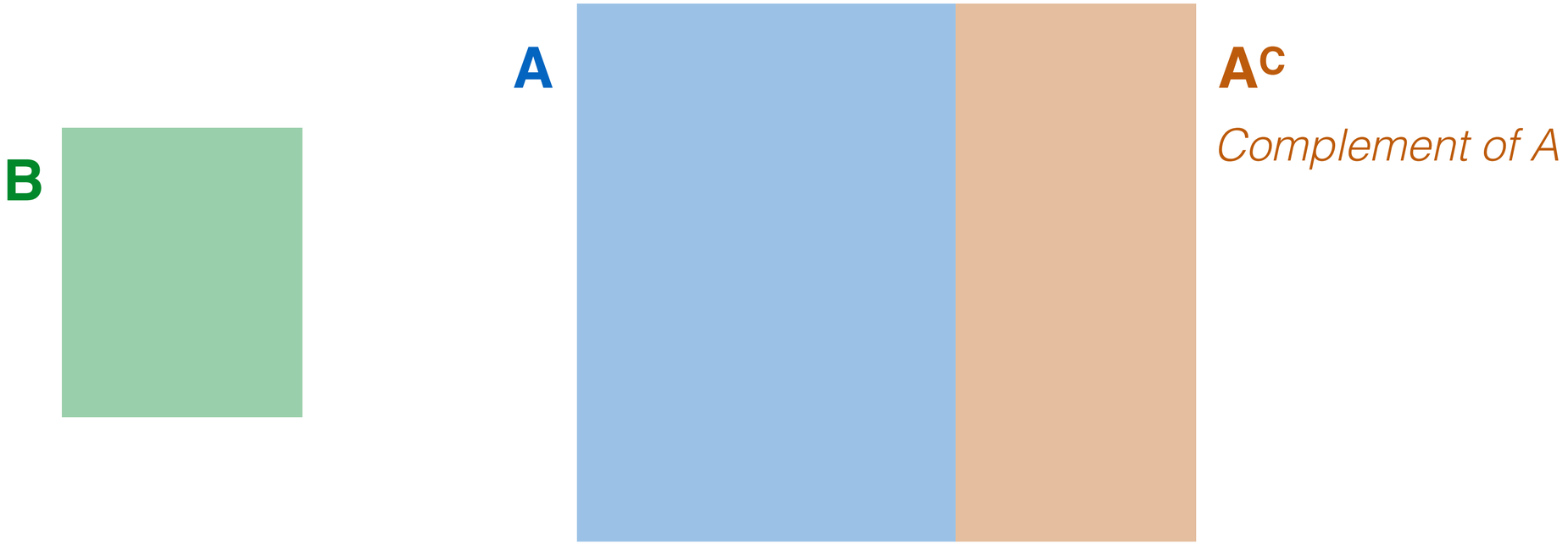
Probability Concepts

Bayes' Formula

PREP nuggets

A and A^C

Mutually exclusive and Exhaustive Events

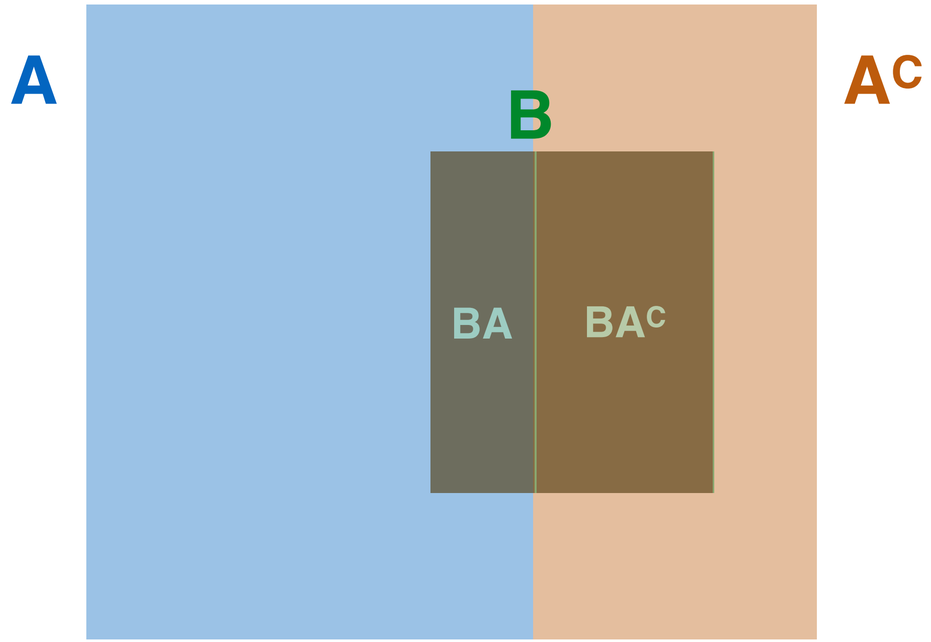


Total Probability Rule

$$P(B) = P(BA) + P(BA^C)$$

Applying Multiplication rule

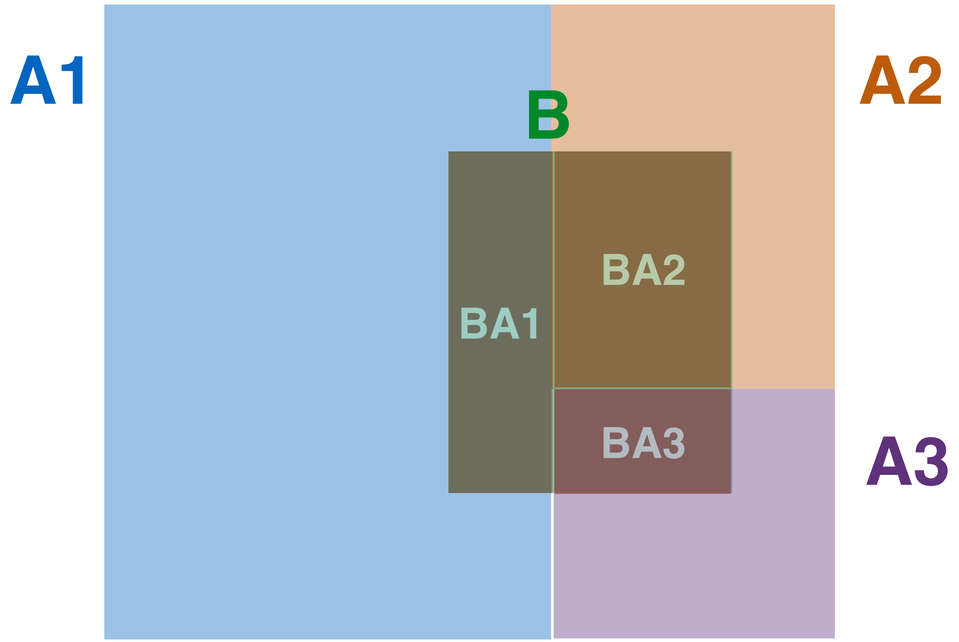
$$P(B) = P(B \mid A) \times P(A) + P(B \mid A^C) \times P(A^C)$$



Total Probability Rule

$$P(B) = P(BA1) + P(BA2) + P(BA3)$$

$$P(B) = P(B \mid A1) \times P(A1) + P(B \mid A2) \times P(A2) + P(B \mid A3) \times P(A3)$$



*A1, A2 and A3 are **mutually exclusive** and **exhaustive***

Bayes' Formula

PREP nuggets

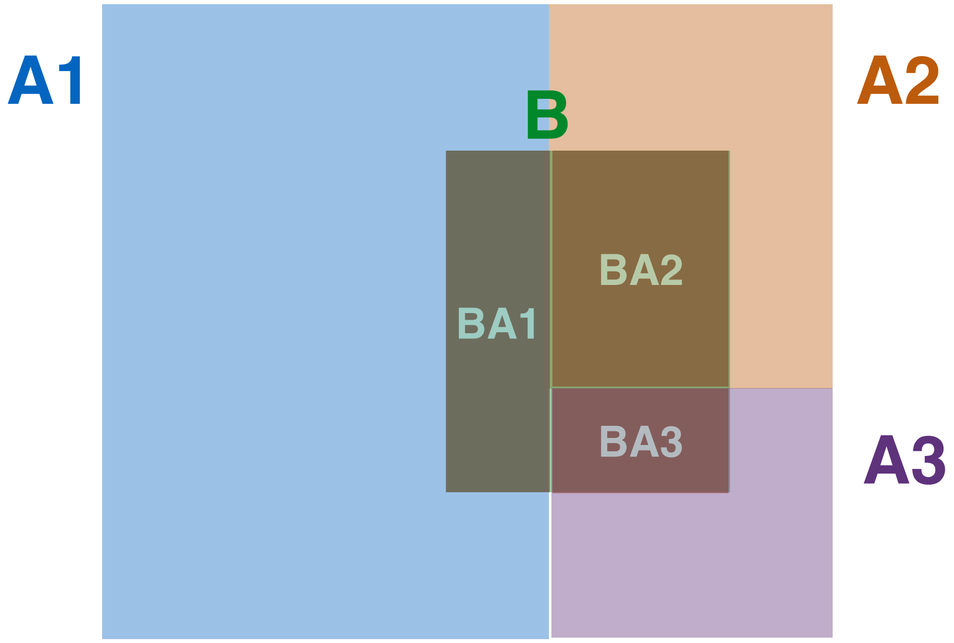
Total Probability Rule

$$P(B) = P(B \mid A1) \times P(A1) + P(B \mid A2) \times P(A2) + P(B \mid A3) \times P(A3)$$

$$= 0.55 \times 0.9 + 0.8 \times 0.05 + 0.3 \times 0.05$$

$$= 0.55$$

Probability of DJIA going up in any given month is 0.55



P(A1)=0.9 *Interest rate unchanged*

P(A2)=0.05 *Interest rate cut*

P(A3)=0.05 *Interest rate increase*

P(B | A1)=0.55 *DJIA up given A1*

P(B | A2)=0.8 *DJIA up given A2*

P(B | A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

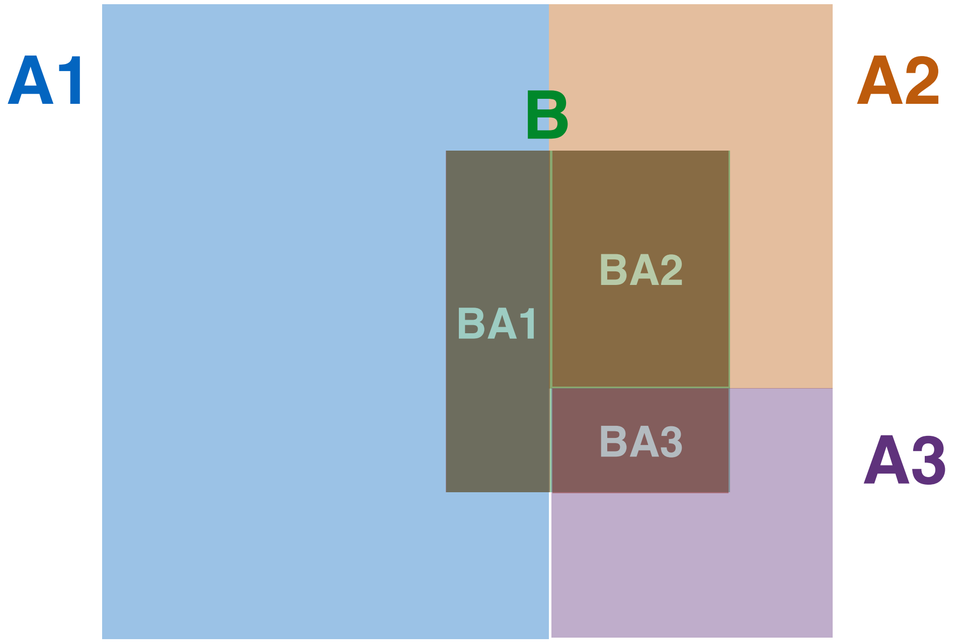
A

What are the likelihood of changes in interest rates?

Estimate

Likelihood of DJIA going up
P(B) = 0.55

B



P(A1)=0.9 *Interest rate unchanged*
P(A2)=0.05 *Interest rate cut*
P(A3)=0.05 *Interest rate increase*

P(B I A1)=0.55 *DJIA up given A1*
P(B I A2)=0.8 *DJIA up given A2*
P(B I A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month

Next Month

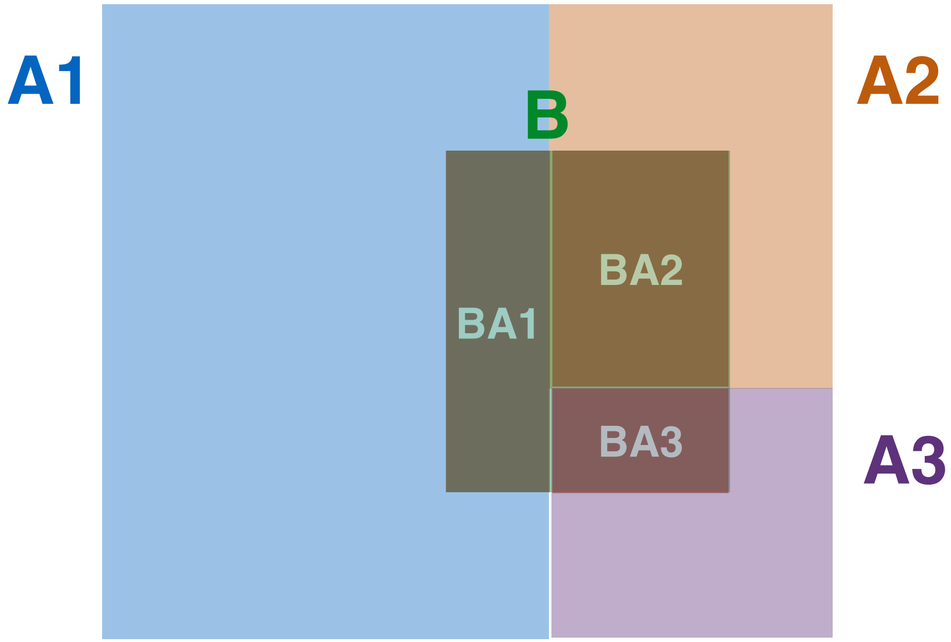
B — **Likelihood of DJIA going up**
P(B) = 0.55

By studying movement of DJIA this month

Estimate

What are the likelihood of changes in interest rates? — **A**

Probability of a particular interest rate decision next month



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P(B I A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month

Next Month

B

DJIA has gone UP!

P(B) = 0.55

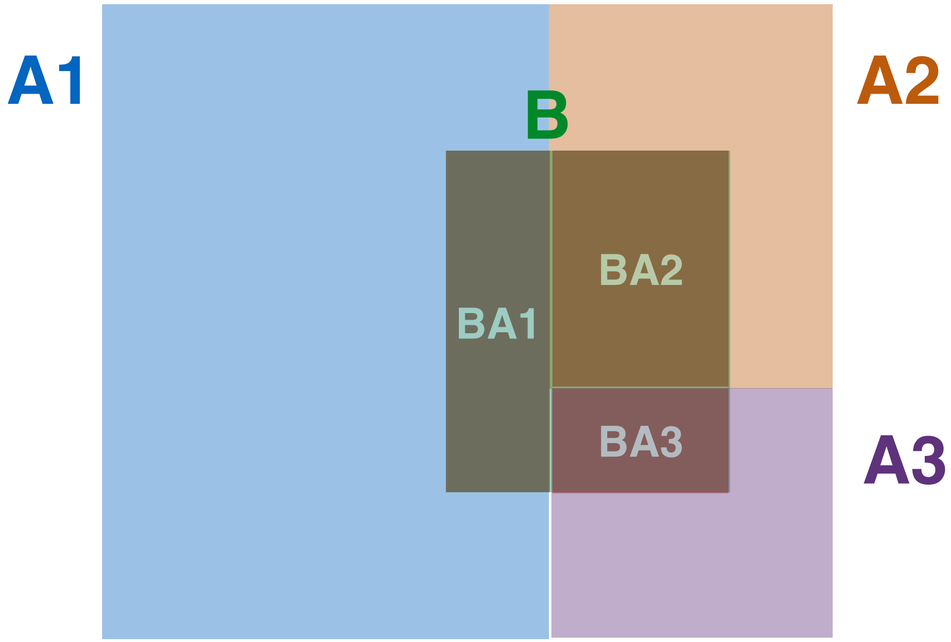
Estimate

What is the likelihood of a rate cut?

A2

By studying movement of DJIA this month

Probability of a particular interest rate decision next month



P(A1)=0.9 *Interest rate unchanged*

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P(A3)=0.05 *Interest rate increase*

P(B I A1)=0.55 *DJIA up given A1*

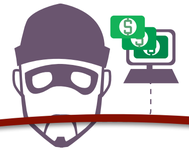
P(B I A2)=0.8 *DJIA up given A2*

P(B I A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month



Next Month

B

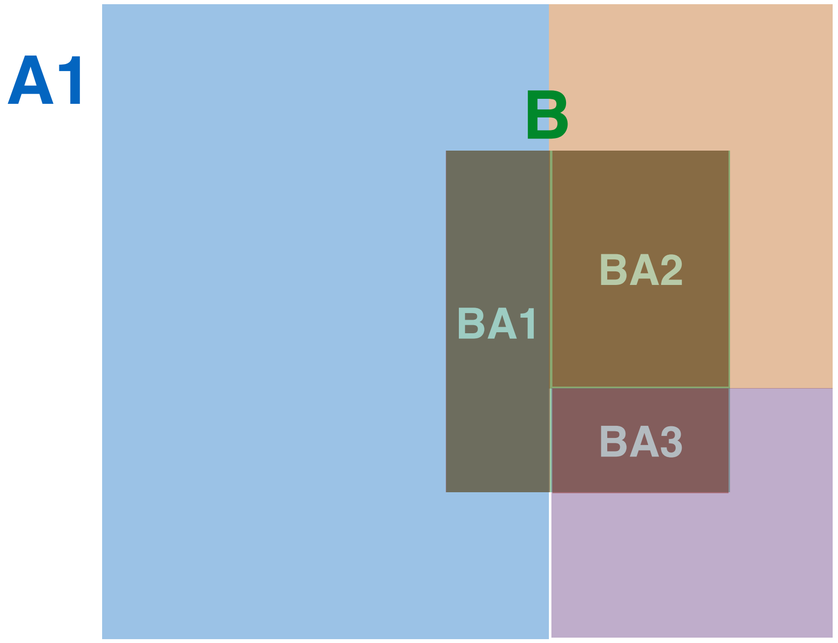
DJIA has gone UP!
P(B) = 0.55

Estimate

What is the likelihood of a rate cut?

A2

New information to update probability



Prior probabilities

P(A1)=0.9 *Interest rate unchanged*
P(A2)=0.05 *Interest rate cut*
P(A3)=0.05 *Interest rate increase*

} *In the following month*

P(B | A1)=0.55 *DJIA up given A1*
P(B | A2)=0.8 *DJIA up given A2*
P(B | A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month

Next Month

B

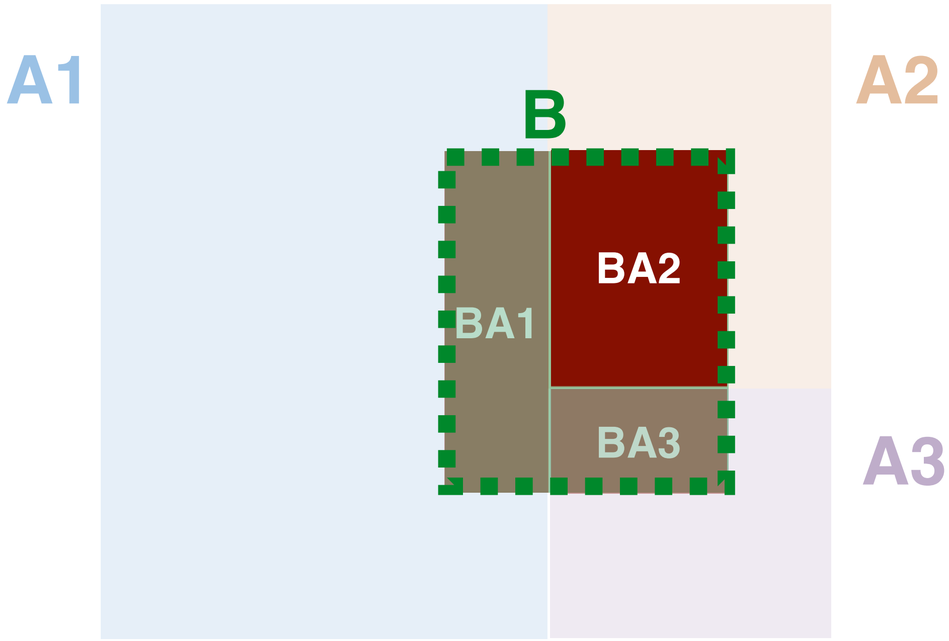
DJIA has gone UP!

P(B) = 0.55

Estimate

What is the likelihood of a rate cut?

A2



Multiplication rule

$$P(A2B) = P(A2 \mid B) \times P(B)$$

Prior probabilities

P(A1)=0.9 *Interest rate unchanged*

P(A2)=0.05 *Interest rate cut*

P(A3)=0.05 *Interest rate increase*

P(B | A1)=0.55 *DJIA up given A1*

P(B | A2)=0.8 *DJIA up given A2*

P(B | A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month

Next Month

B

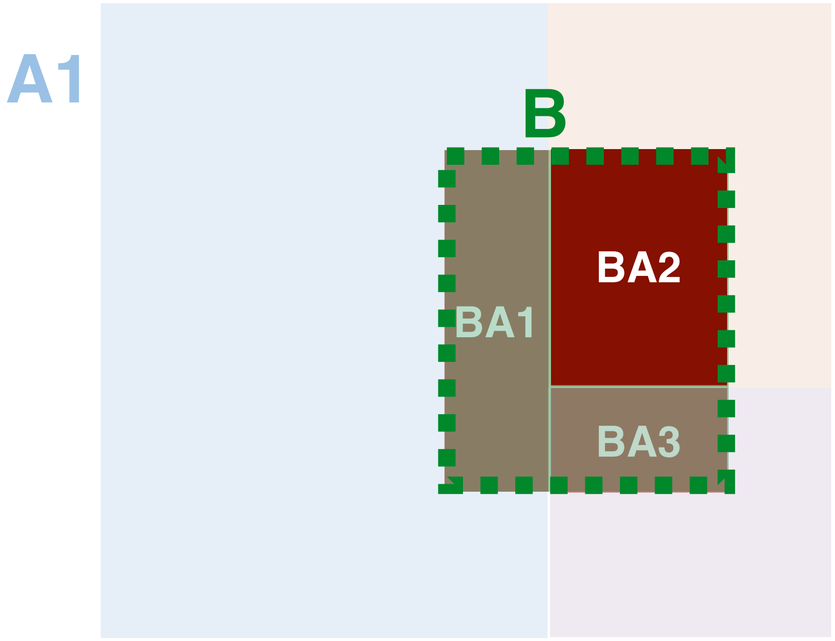
DJIA has gone UP!

P(B) = 0.55

Estimate

What is the likelihood of a rate cut?

A2



Multiplication rule

$$P(A2 \mid B) = \frac{P(B \mid A2) \times P(A2)}{P(B)}$$

$$= (0.8 \times 0.05) / 0.55$$

$$= 0.07$$

Prior probabilities

P(A1)=0.9 *Interest rate unchanged*

P(A2)=0.05 *Interest rate cut*

P(A3)=0.05 *Interest rate increase*

P(B | A1)=0.55 *DJIA up given A1*

P(B | A2)=0.8 *DJIA up given A2*

P(B | A3)=0.3 *DJIA up given A3*

PREP nuggets

Bayes' Formula

This Month

Next Month

B

DJIA has gone UP!

P(B) = 0.55

Estimate

What is the likelihood of a rate cut?

A2

$$P(A2 \mid B) = \frac{P(B \mid A2) \times P(A2)}{P(B)}$$

DJIA has gone up!

P(A2)=0.05

Probability of rate cut

New Info
B is TRUE

P(A2 | B) = 0.07

Probability of rate cut given that we know DJIA has gone up!

PREP nuggets

Bayes' Formula

This Month

Next Month

B

DJIA has gone UP!

P(B) = 0.55

Estimate

What is the likelihood of a rate cut?

A2

$$P(A2 \mid B) = \frac{P(B \mid A2) \times P(A2)}{P(B)}$$

Bayes' Formula

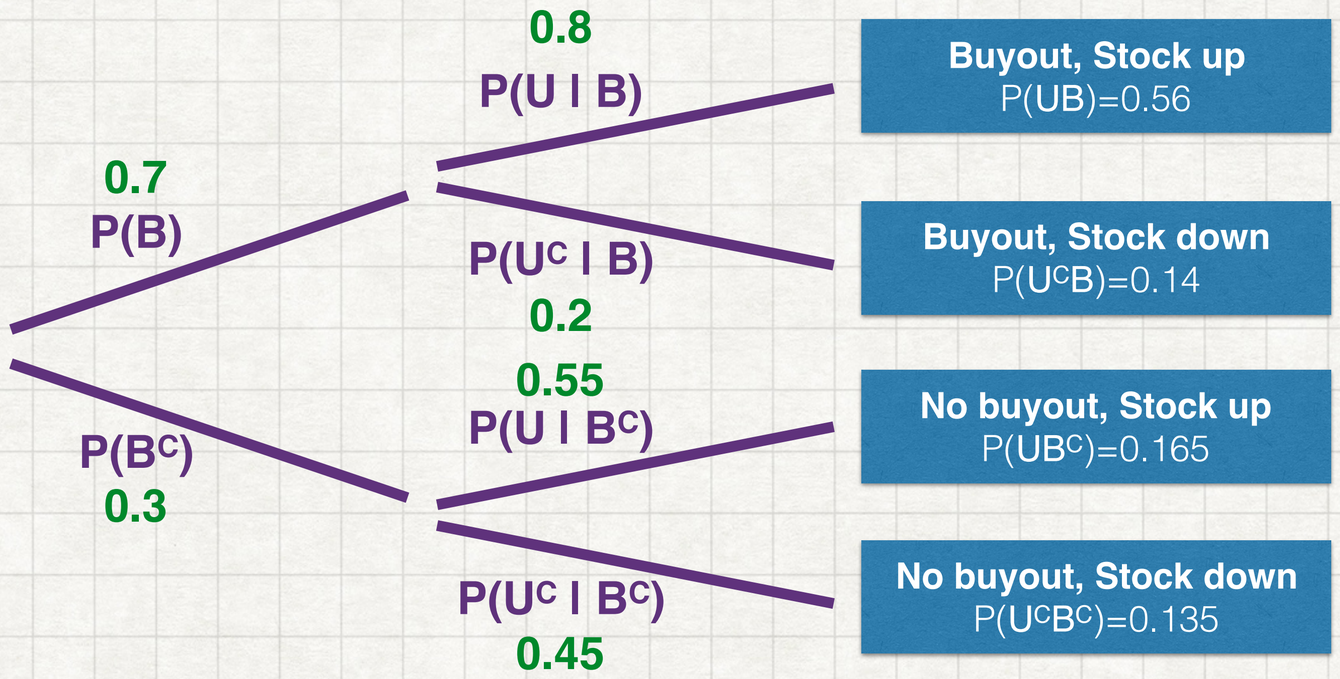
$$P(Event \mid Info) = \frac{P(Info \mid Event) \times P(Event)}{P(Info)}$$

Event: *I/R increase*
Info: *DJIA up*

P(A2)=0.05 → **New Info B is TRUE** → **P(A2 | B) = 0.07**

Robert Holmes, CFA estimates that the probability of a buyout (B) of Pinnacle Inc is 70%. If it does, there is an 80% chance that the stock of Pinnacle Inc will go up (U). If there is no buyout, the chances that the stock will go up is 55%.

Given that the stock of Pinnacle went up, what is the updated probability of a buyout?



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Given that the stock of Pinnacle went up, what is the updated probability of a buyout?

Bayes' Formula

$$P(\text{Event} \mid \text{Info}) = \frac{P(\text{Info} \mid \text{Event}) \times P(\text{Event})}{P(\text{Info})}$$

Event: Buyout (B)

Info: Stock went up (U)

Robert Holmes, CFA estimates that the probability of a buyout (B) of Pinnacle Inc is 70%. If it does, there is an 80% chance that the stock of Pinnacle Inc will go up (U). If there is no buyout, the chances that the stock will go up is 55%.

Given that the stock of Pinnacle went up, what is the updated probability of a buyout?

Bayes' Formula

$$P(B \mid U) = \frac{P(U \mid B) \times P(B)}{P(U)}$$

Event: Buyout (B)

Info: Stock went up (U)

Robert Holmes, CFA estimates that the probability of a buyout (B) of Pinnacle Inc is 70%. If it does, there is an 80% chance that the stock of Pinnacle Inc will go up (U). If there is no buyout, the chances that the stock will go up is 55%.

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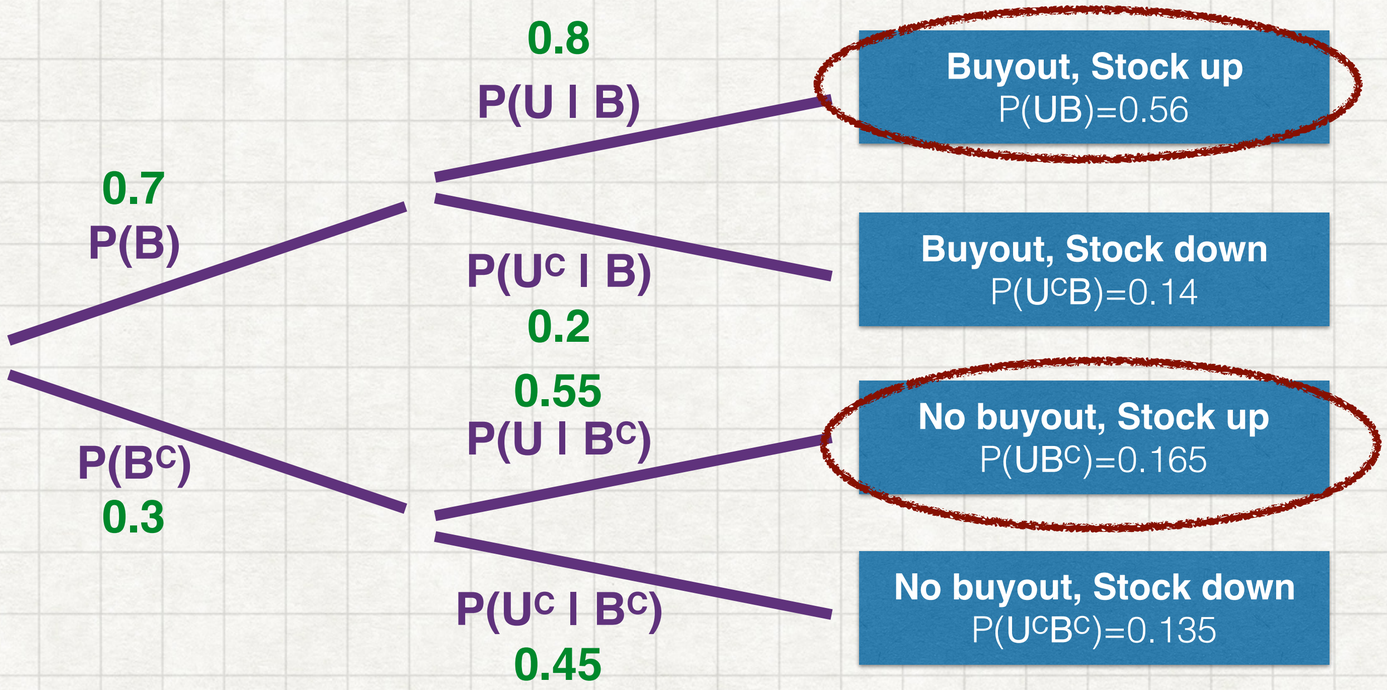

$$P(B \mid U) = \frac{P(U \mid B) \times P(B)}{P(U)}$$

$$= \frac{P(U \mid B) \times P(B)}{P(UB) + P(UB^C)}$$

Total probability rule

$$= \frac{0.8 \times 0.7}{0.56 + 0.165}$$

$$= 0.77$$

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