Valuation:
An Exercise to Illuminate Techniques of Approximating the Value of an Opportunity

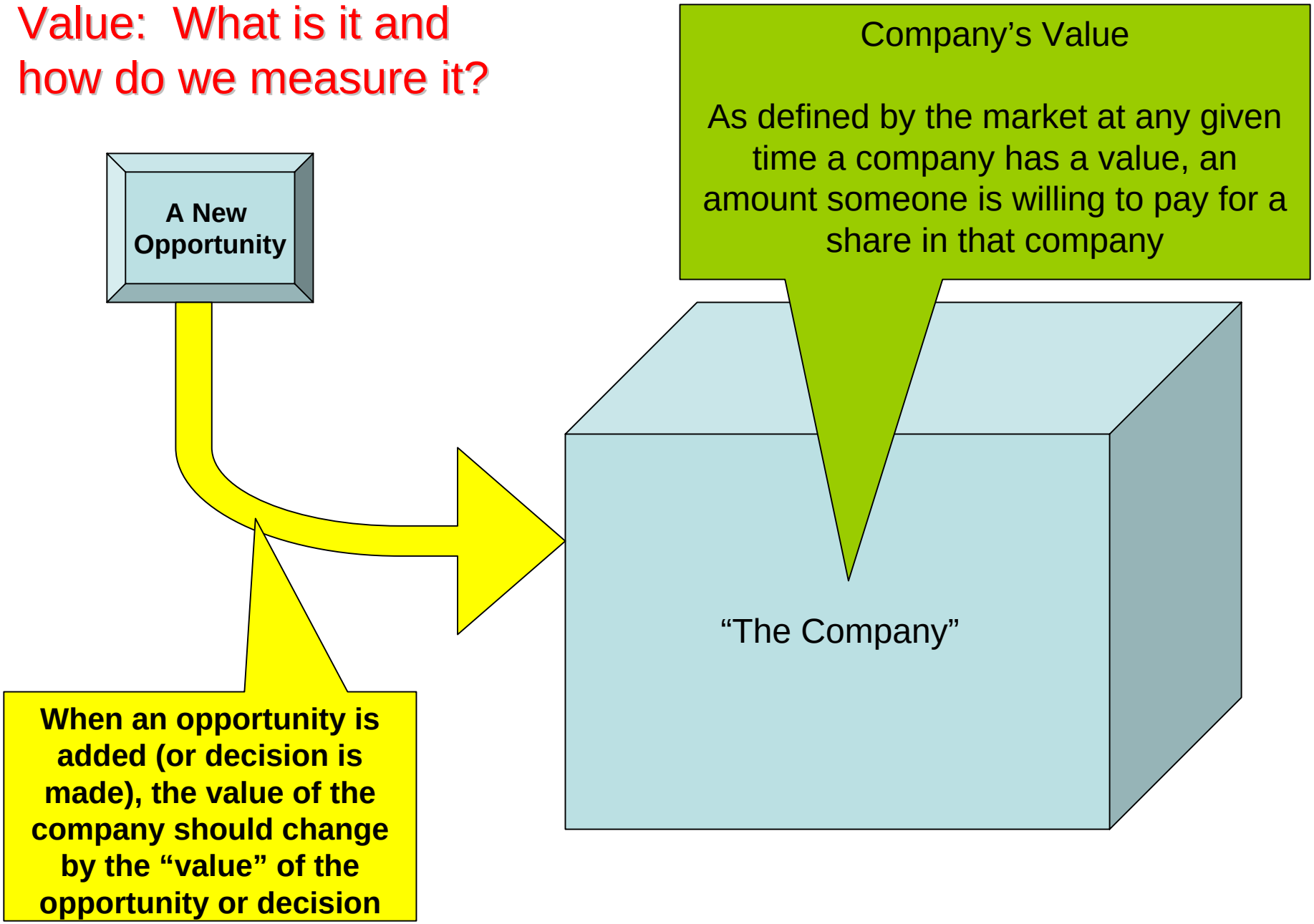
Or

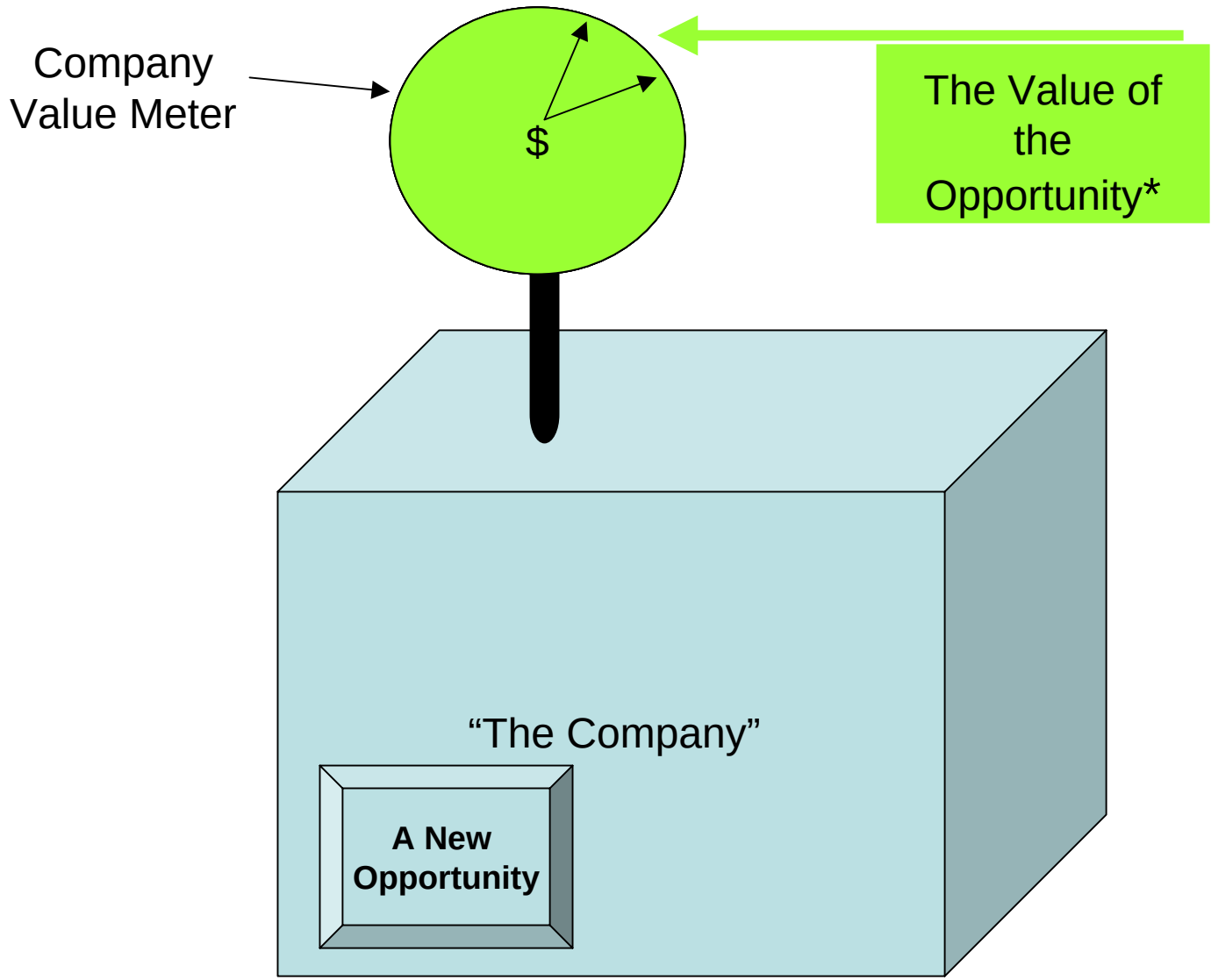
"Whazzit worth?"

Frank Koch
Chevron

DAAG 2006

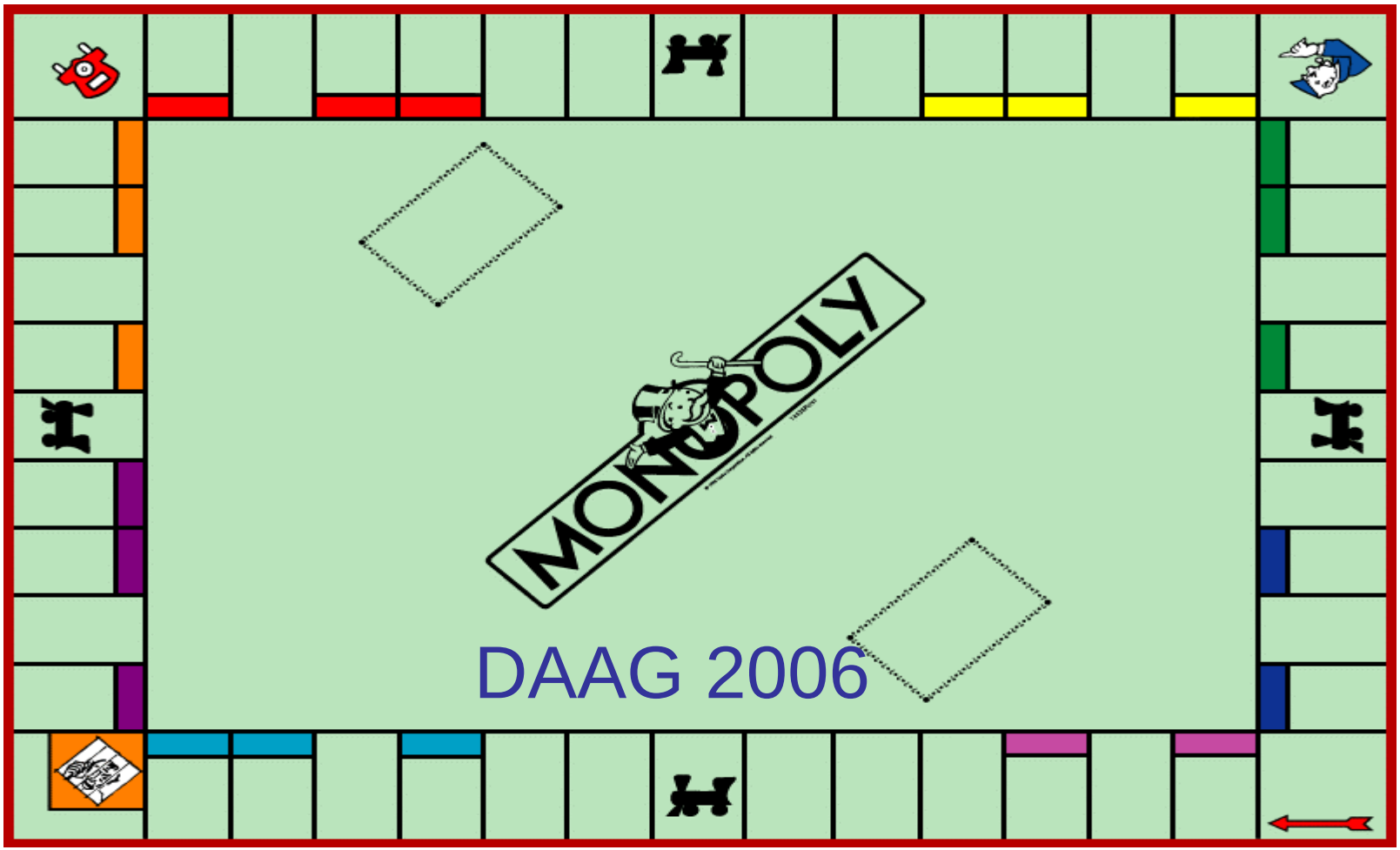
Value: What is it and how do we measure it?





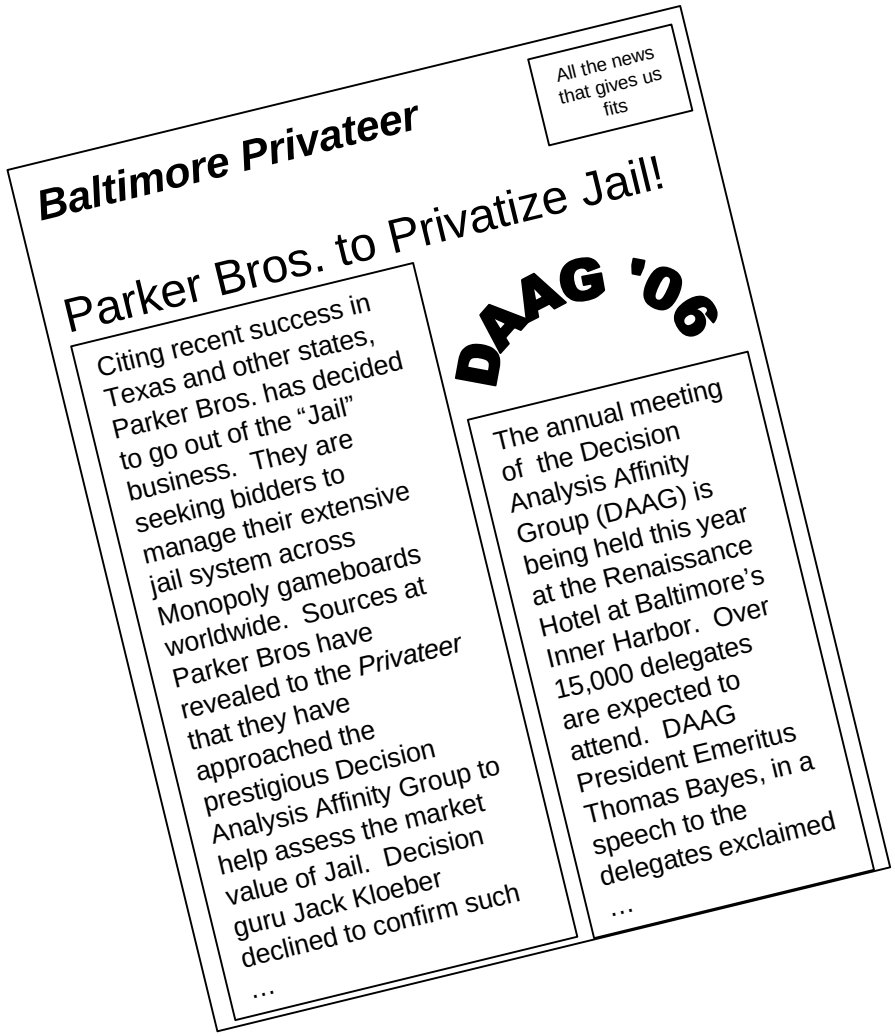
* This may have little or no relationship to how a decision maker or manager values the opportunity, and yet most companies pretend it does

The Monopoly® Valuation Exercise



What's Jail Worth?

- The "In Jail" square is the only Revenue generating property that can't be owned!
- What would you pay to own "Jail"?
- What is the "fair market value" of Jail based on the value proposition embedded in Monopoly®?



Baltimore Privateer

All the news that gives us fits

Parker Bros. to Privatize Jail!

Citing recent success in Texas and other states, Parker Bros. has decided to go out of the "Jail" business. They are seeking bidders to manage their extensive jail system across Monopoly gameboards worldwide. Sources at Parker Bros have revealed to the *Privateer* that they have approached the prestigious Decision Analysis Affinity Group to help assess the market value of Jail. Decision guru Jack Kloeber declined to confirm such …

DAAG '06

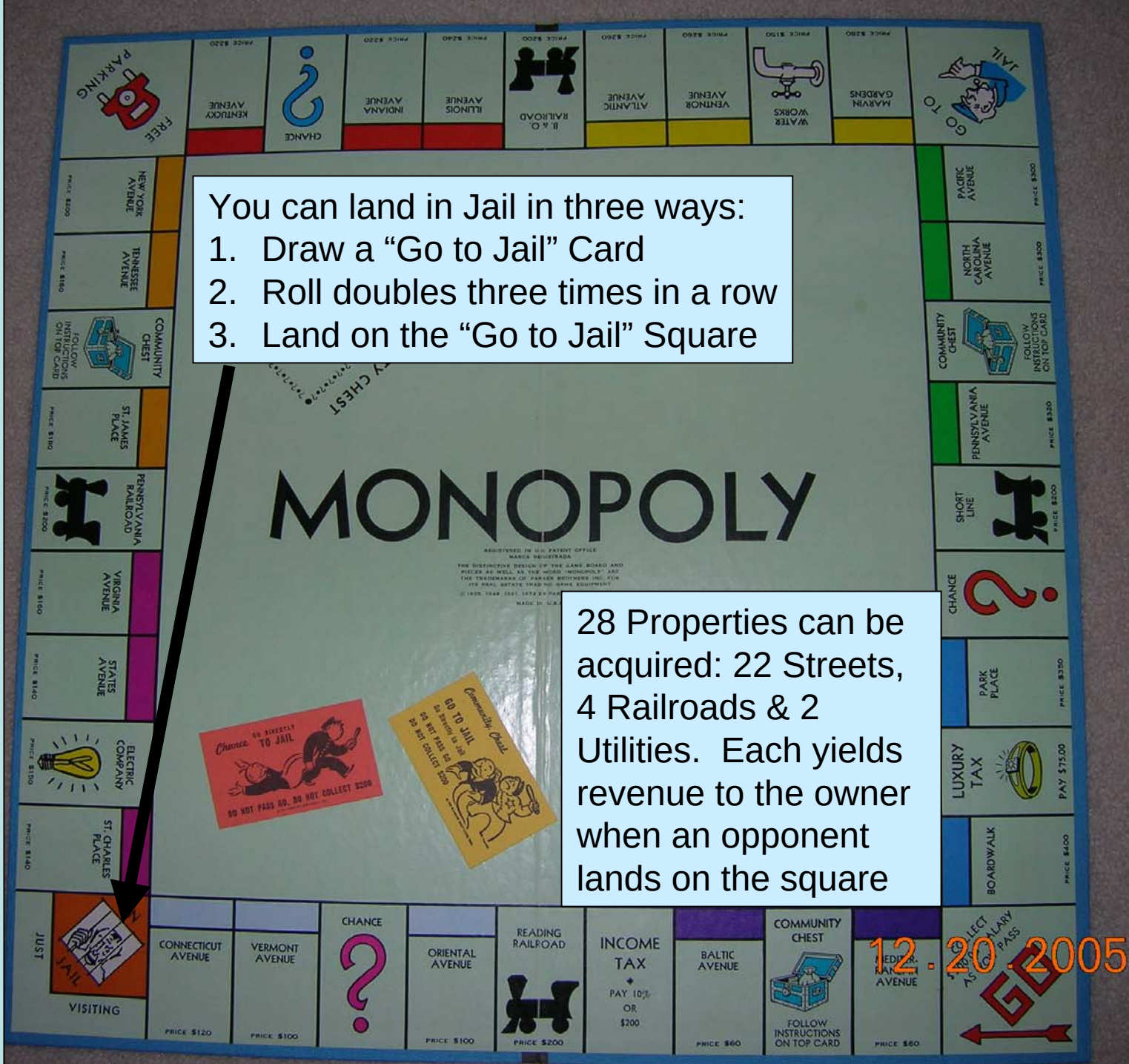
The annual meeting of the Decision Analysis Affinity Group (DAAG) is being held this year at the Renaissance Hotel at Baltimore's Inner Harbor. Over 15,000 delegates are expected to attend. DAAG President Emeritus Thomas Bayes, in a speech to the delegates exclaimed …

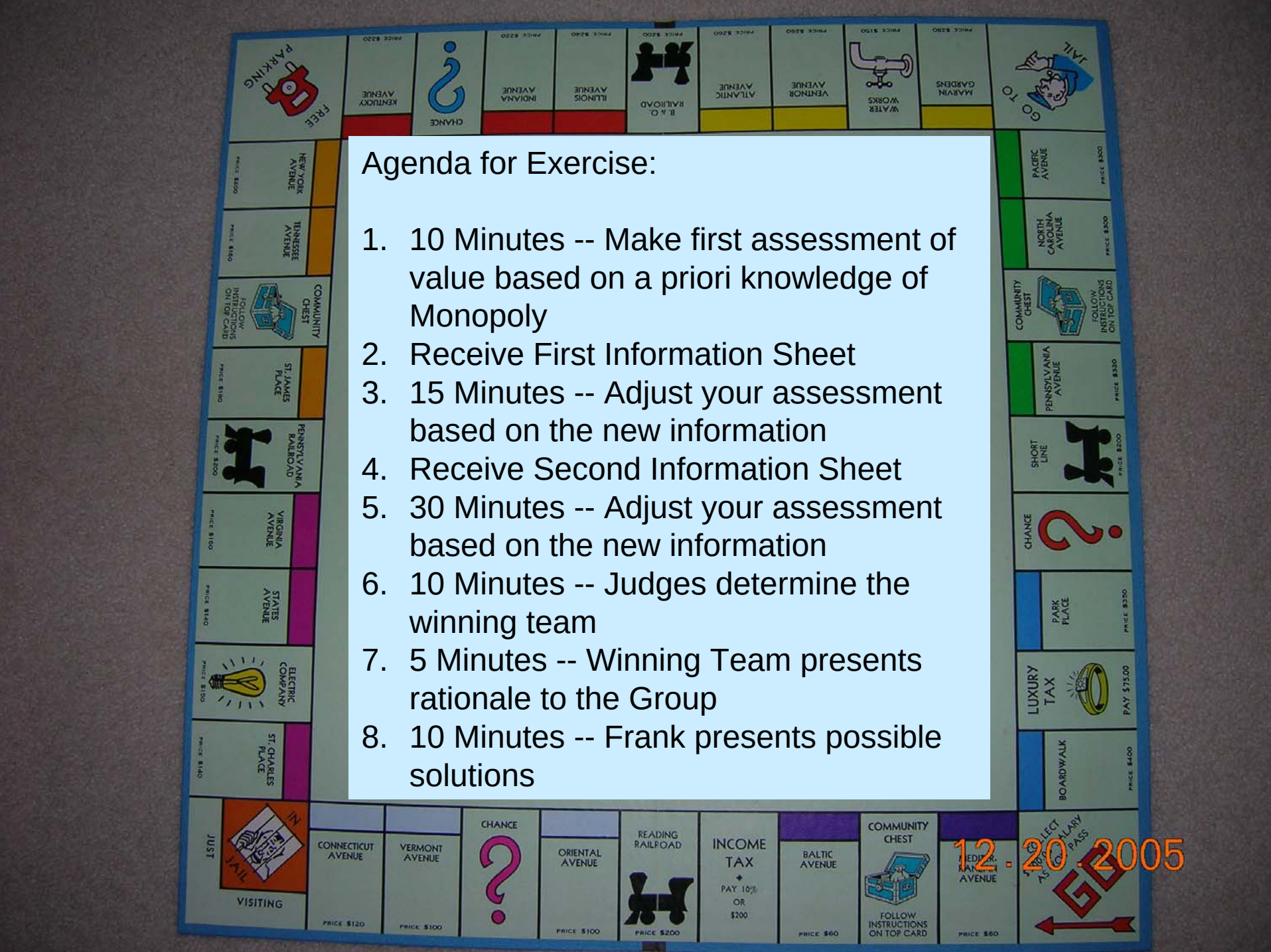
To get out of Jail

1. Roll Doubles

2. Use “Get out of Jail” Card

3. Pay $50 – **This would be the revenue to the owner of Jail**




Agenda for Exercise:
1. 10 Minutes -- Make first assessment of value based on a priori knowledge of Monopoly
2. Receive First Information Sheet
3. 15 Minutes -- Adjust your assessment based on the new information
4. Receive Second Information Sheet
5. 30 Minutes -- Adjust your assessment based on the new information
6. 10 Minutes -- Judges determine the winning team
7. 5 Minutes -- Winning Team presents rationale to the Group
8. 10 Minutes -- Frank presents possible solutions
12 - 20 - 2005

Suggested Answers

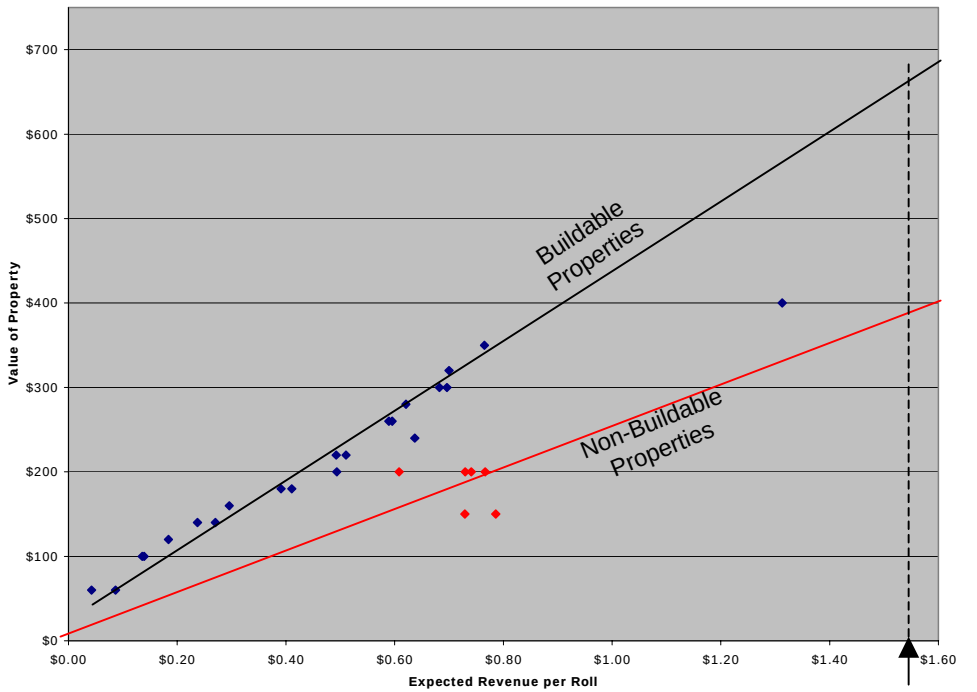
- Generally, there are 4 different approaches taken to place a value on “Jail”
  - The Realtor Approach
  - The Simulation Approach
  - The Revenue Match Approach
  - The Portfolio Replication Approach

- The Realtor Approach –
  - Look at neighboring properties and place value within that range
    - Vermont Ave -- $100
    - Connecticut Ave --$120
    - St. Charles Place --$140
    - Electric Company --$150
    - States Ave --$140
  - Average Value = $130

- The Simulation Approach
  - Model the game simulating how often an opponent lands in Jail and how often they pay to get out
  - This results in an expected cash flow stream from “Jail” which can be valued in terms of its expected net present value
  - Caveat: This approach yields varying values depending on the length you assume the game is played

- The Revenue Match Approach
  - Estimate the Expected Revenue per roll and use the ratio of Value to Expected Revenue for other properties to assess Jail

• Jail would be valued at about $395 using the ratio from the non-buildable properties (utilities + RRs)
• The ~$270 additional value using the buildable ratio represents the “option” value of building houses



- The Portfolio Replication Approach
  - This is the approach that won the Nobel Prize for Black, Scholes & Merton
  - Take two portfolios of properties (one of them should include Jail)
  - Select them so that their risk (probability of landing on the portfolio) is equal and that the expected revenue from each is equal
  - Then the value of the two portfolios should also be equal and the value of Jail can be directly calculated

The Portfolio Replication Approach

Portfolio A:
1. New York Avenue
2. Mediterranean Avenue
3. "In Jail"

Probability* of Landing on "A"
3.09% + 2.13% +3.95% =
9.17%

Rent‡

New York Ave	$16
Mediterranean	$ 2
In Jail	???

Portfolio B:
1. Illinois Avenue
2. Pennsylvania RR
3. B&O RR

Probability of Landing on "B"
3.19% + 2.92% +3.07% =
9.17%

Rent

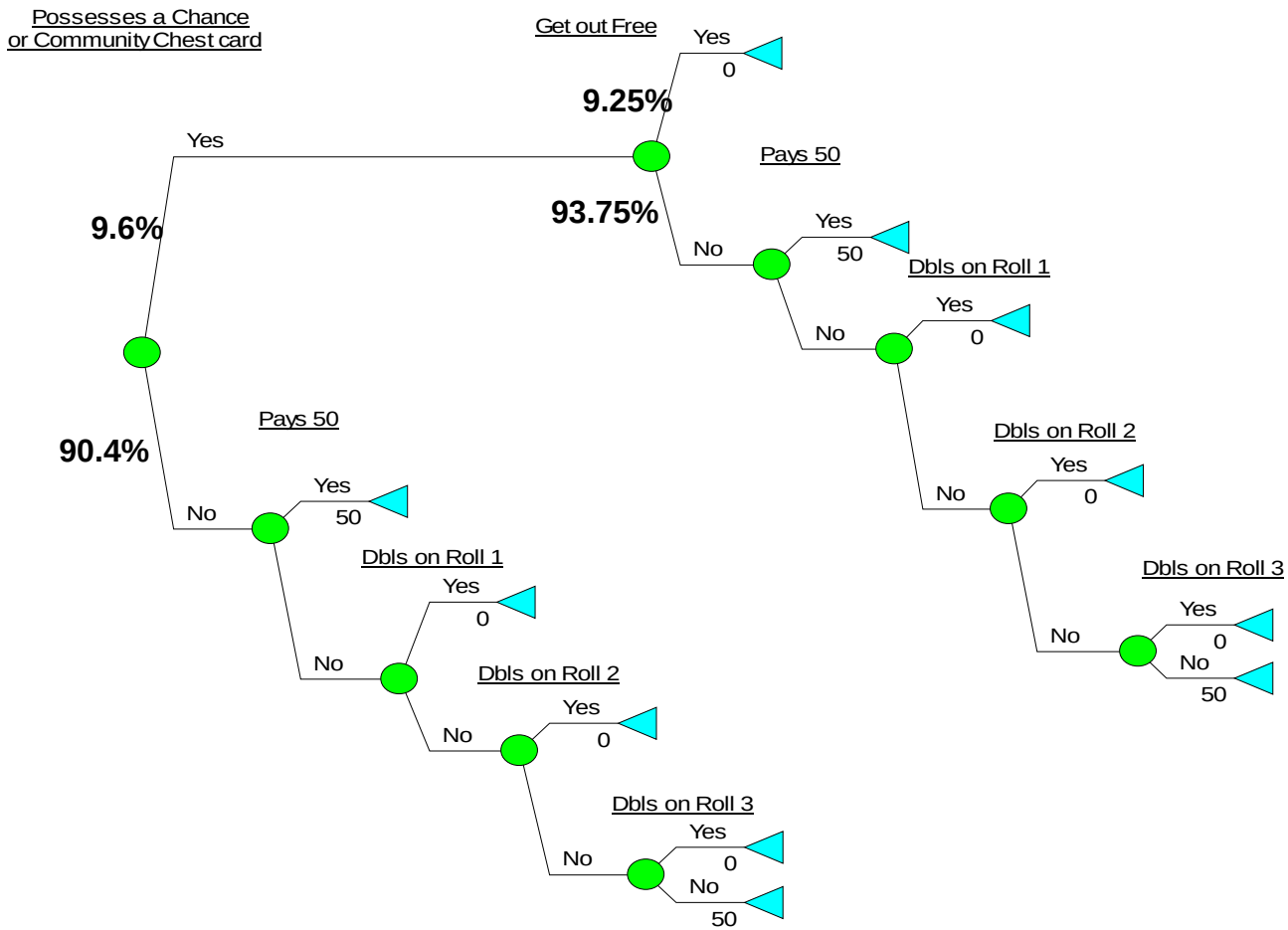
Illinois Ave	$20
Penn RR	$25
B&O RR	$25

***** From the table handed out as the second info sheet
‡ From the table handed out as the first info sheet

The Portfolio Replication Approach

- Calculate the expected revenue from Jail

EV Revenue = $39



The Portfolio Replication Approach

Portfolio A:
1. New York Avenue
2. Mediterranean Avenue
3. "In Jail"

Probability of Landing on "A"
3.09% + 2.13% +3.95% =
9.17%

Rent

New York Ave	$16
Mediterranean	$ 2
In Jail	$39
Expected Rent	$22.75

Portfolio B:
1. Illinois Avenue
2. Pennsylvania RR
3. B&O RR

Probability of Landing on "B"
3.19% + 2.92% +3.07% =
9.17%

Rent

97.8% Equity

Illinois Ave	$20	
Penn RR	$25	
B&O RR	$25	
Expected Rent	$23.26	$22.75

So the value of Portfolio A must equal the value of 97.8% equity in Portfolio B

The Portfolio Replication Approach

Portfolio A:	Value
1. New York Avenue	=$200
2. Mediterranean Avenue	=$ 60
3. "In Jail"	= X

Portfolio B:	Value
1. Illinois Avenue	=$240
2. Pennsylvania RR	=$200
3. B&O RR	=$200
	$640

$626

97.8%

$626

X = 626 – 200 – 60

The Value of Jail = $366

The Portfolio Replication Approach yields a value of $366, the Revenue Match Approach yields $395. If make a simple consistency check: The rent on Park Place =$35, on Boardwalk =$50, their values are $350 and $400 respectively. Interpolating Jail's $39 Expected Rent yields a value of $363!

My source for the long term probabilities in Monopoly:
http://www.tkcs-collins.com/truman/monopoly/monopoly.shtml

The Portfolio Replication Approach

Note that three different portfolios have the same risk (9.17%) and reward ($22.66 expected rent) as Portfolio A which includes Jail

Portfolio B:
97.8% of
1. Illinois Avenue
2. Pennsylvania RR
3. B&O RR

"In Jail" is worth $363

Portfolio C:
122.2% of
1. Baltic Avenue
2. Park Place
3. Short Line RR
4. States Avenue

"In Jail" is worth $656

Portfolio D:
122.9% of
1. Baltic Avenue
2. Park Place
3. Vermont Avenue
4. Pennsylvania Avenue

"In Jail" is worth $760

I did not use portfolios C & D because you need to own more than 100% of the portfolio to yield the expected rent and both contain significantly more option value from the option to build houses and hotels.