

# **USING DFA TO OPTIMIZE THE VALUE OF REINSURANCE**

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**BENFIELD BLANCH  
Nathan Schwartz**

# THE QUESTIONS

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- What type of reinsurance to purchase?
- How much reinsurance to purchase?

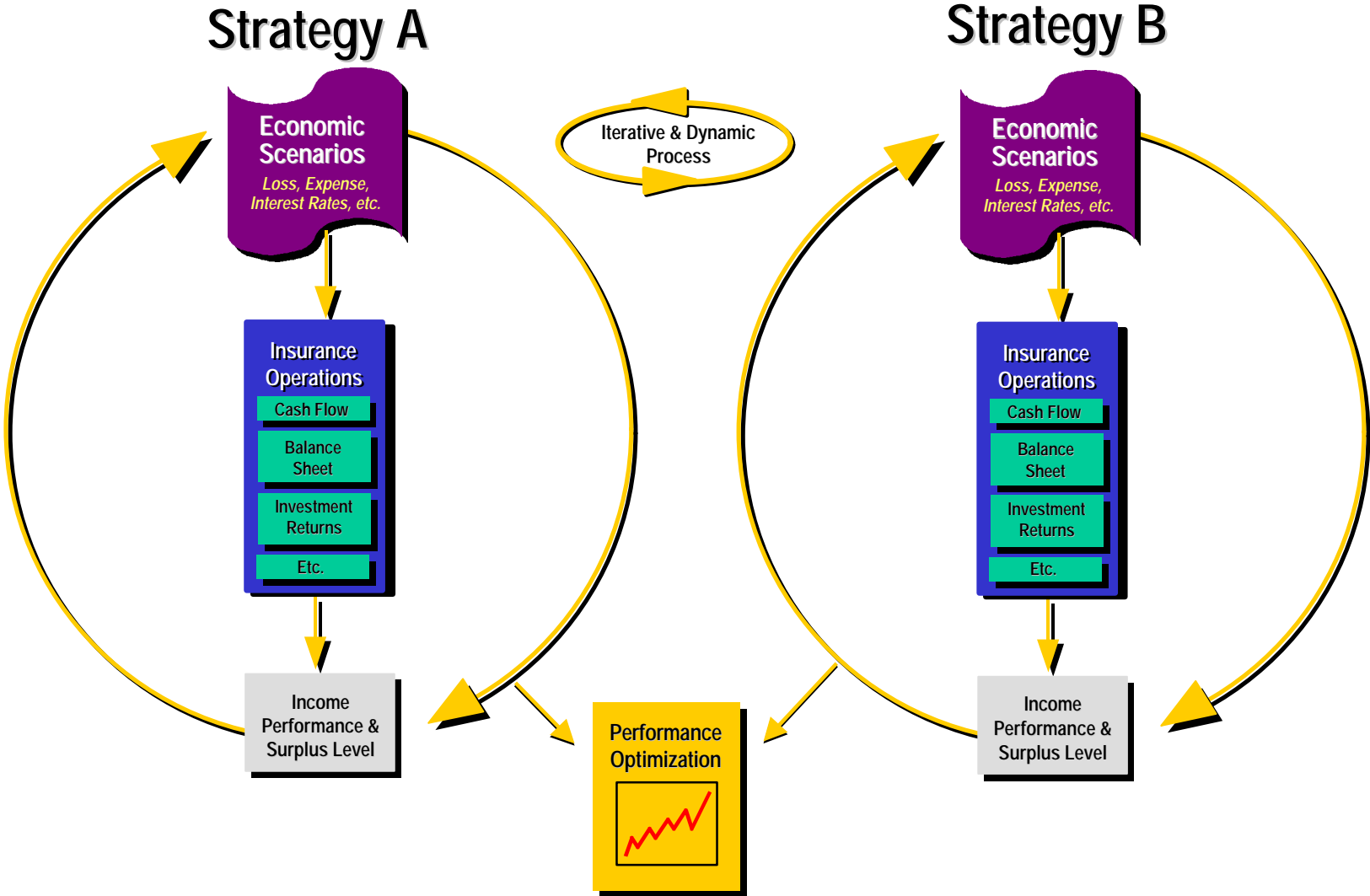
# WHY DFA?

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- DFA allows level comparison of widely differing reinsurance programs
- Focus on risk and return
- Ignore non-loss risks

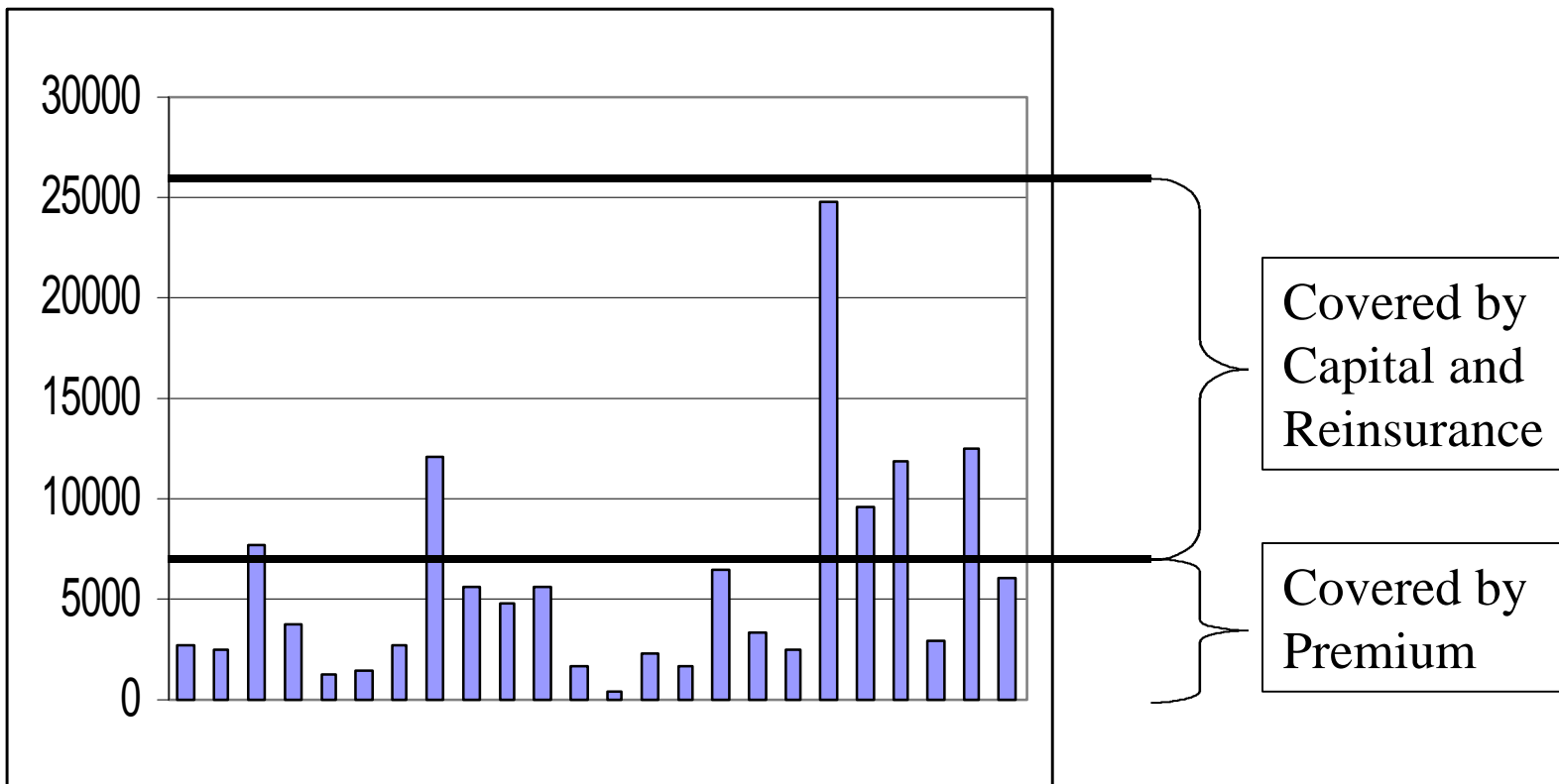
# DFA EVALUATION & DESIGN

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# REINSURANCE AS CAPITAL

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# REINSURANCE AS CAPITAL

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- Reinsurance and capital can serve the same function in selling risk
- An increase in reinsurance should decrease the need for capital and vice versa
- Capital is generally constrained, while reinsurance is flexible

# THE GENERAL PLAN

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- Develop a “space” of possible reinsurance structures
- Predict market pricing of reinsurance alternatives
- Measure changes in net risk and return
- Use rules or metrics to rank (traditionally between risk and return) possibilities
- Find the optimal solution

# THE GENERAL PLAN

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- Easy right?
- The devil is in the details
- Every step of the process has open questions



# THE EXAMPLE

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- Butterfly Insurance
  - Florida Homeowners Book
  - Large cat exposure

# THE EXAMPLE

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PML Table  
for Butterfly Insurance Company

	<u>2001</u>	Return Time	Loss (000's)
		2	266
		3	2,418
Acquisition Costs	21,012	4	9,982
Premium Taxes, Licenses and Fees		5	21,327
Other Underwriting Expenses Incurred		10	105,523
Total Loss & Expenses Incurred		20	259,234
		25	297,024
Gross Underwriting Gain (Loss)	50,891	50	451,931
		100	626,631
Surplus BOY	134,321	250	836,521
		500	1,049,959
		1,000	1,206,906
		10,000	1,886,538

# REINSURANCE SPACE

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- Quota Share
  - Excess of Loss
  - Clash
  - Catastrophe
  - Facultative
  - Surplus share
  - Adverse development
  - Asset protection
- Coverage
  - Placement
  - Profit sharing
  - Limit
  - Other
    - sublimits
    - cash flows

# BUTTERFLY INSURANCE

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- |       |                   |
|-------|-------------------|
| • Cat | Limit / Retention |
| • QS  | Placement         |
- Maximum (90%) participation in FHCF  
Limit: 412,382 / Retention: 94,354 / Premium: 18,716
  - Catastrophe Reinsurance will inure to the benefit of the Quota Share

# REINSURANCE PRICING

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- Doesn't matter how accurately you measure risk and return if your prices are wrong
- Doesn't matter what the theoretical price should be if no-one will sell it
- If only one variable then can solve for price
- Open question: correct risk load

# POTENTIAL RISK LOADS

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- Multiple of Standard Deviation
- CAPM
- Return on reinsurer's capital
- Heuristics
  - Rule of 100/80'ths
  - Ceded Combined Ratio
  - Margin based on probability of attachment

# BUTTERFLY INSURANCE

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- Use multiple of standard deviation for risk load on catastrophe reinsurance

Net premium = pure premium + 50% standard deviation

- Quota share ceding commission implies a 90% ceded combined ratio

# MEASURE CHANGES IN NET RISK

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- What is Risk?
  - Risk of Ruin
  - Expected Policyholder deficit
  - Tail Value at Risk
  - Value at Risk
  - Standard Deviation
  - Others
- Open Question: What is the proper measure of risk?



# BUTTERFLY INSURANCE

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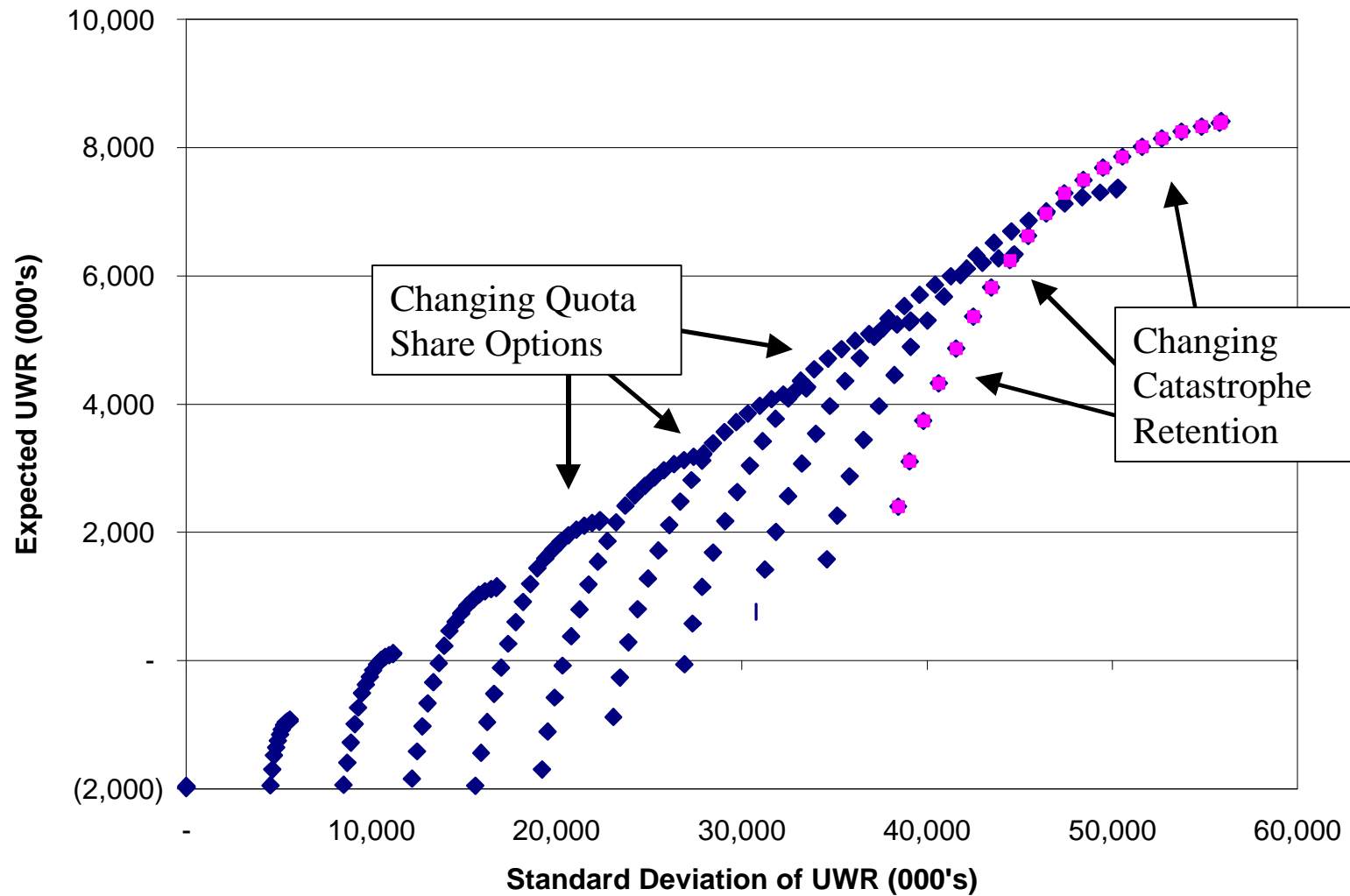
- Capital available and reinsurance purchased must imply a 1% RoR
  - the total amount of reinsurance purchased will remain the same (in terms of RoR), but there will be a tradeoff between catastrophe reinsurance and quota share
- Maximize Return on Capital
- Minimize Standard Deviation

# FIND THE EFFICIENT FRONTIER

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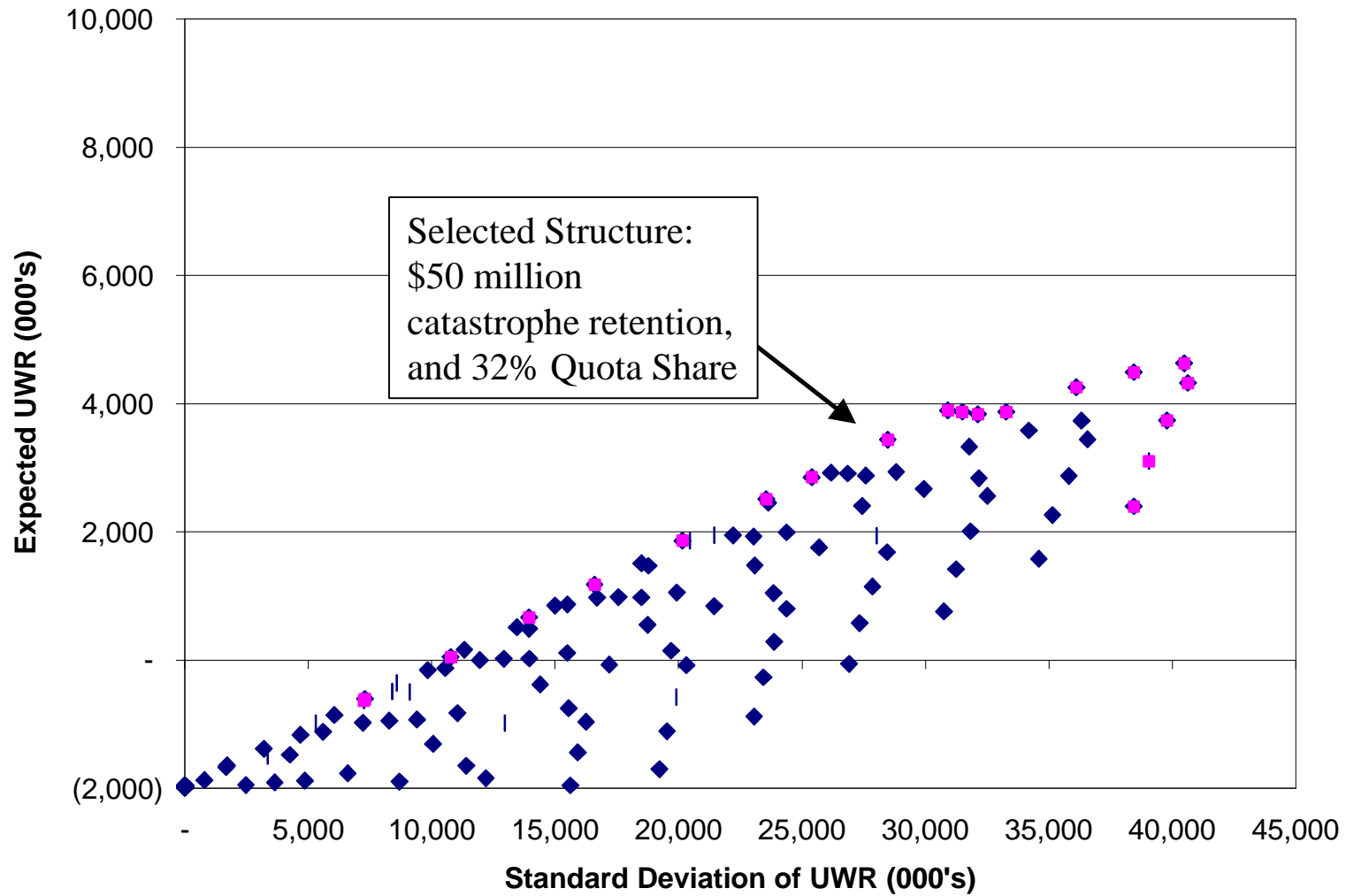
- Heuristic / Judgement
  - Exhaustive Search
  - Simplex Method
  - Genetic Algorithms
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- Open Question: How do you optimize over such a complex space?

# RANK POSSIBILITIES (no constraint)



# RANK POSSIBILITIES (with constraint)

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# Summary

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- Technical Solutions are coming. . . .Slowly
- Judgement Judgement Judgement