

# OPERATIONS RESEARCH

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## ABOUT ME

- Former MATSE student
- Master in Operations Research (Maastricht)
- PhD: Agent-based modelling of Sex, Plants and Sustainability
- Now: Lecturer at Maastricht University
- At the intersection of computer science and applied mathematics

# OPERATIONS RESEARCH

## - WHAT IS THAT??-

- We use mathematical models, data analysis and systematic thinking to make better decisions
- Applications
  - Logistics,
  - Healthcare,
  - Finance,
  - ...

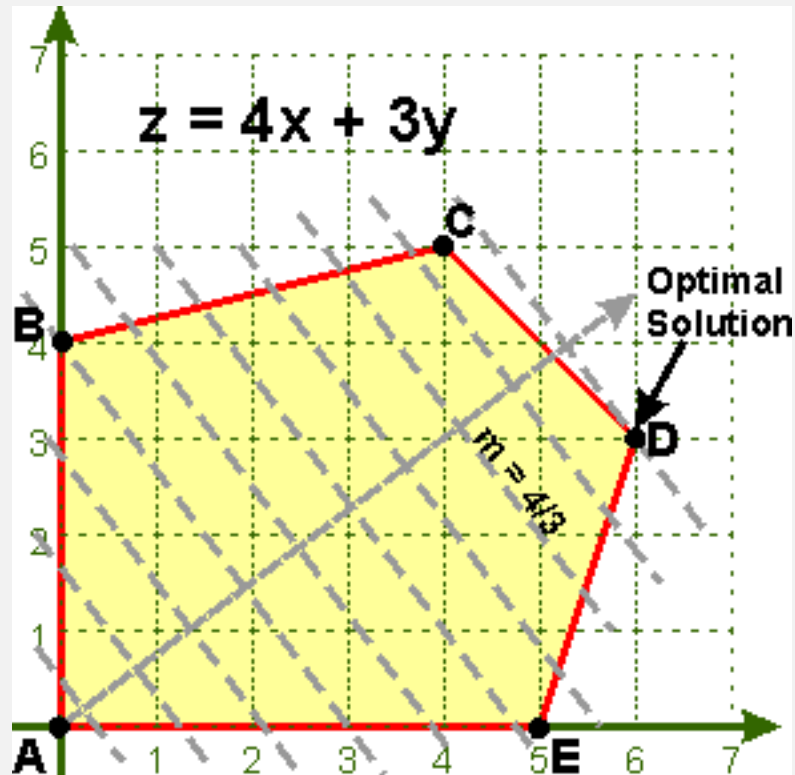
# OPERATIONS RESEARCH

## - WHAT TOPICS DO WE COVER? -

- The Method of Linear Programming
- The Transportation Problem
- The Fundamentals of Markov Chains
- The Fundamentals of Queueing
- Introduction to Game Theory

# LINEAR PROGRAMMING

- MAXIMIZE/MINIMIZE UNDER CONSTRAINTS -



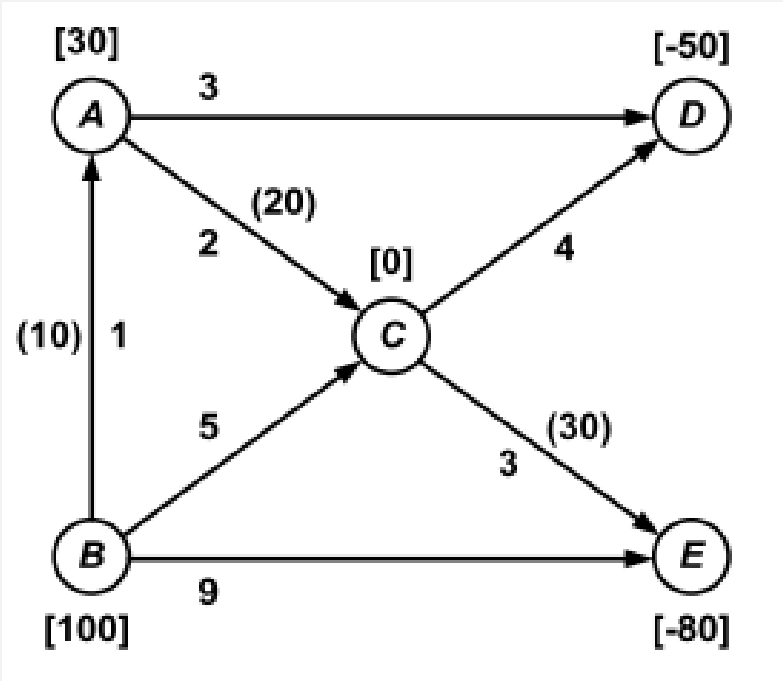
How to calculate efficiently,  
which corner point maximizes  $4x + 3y$ ?

# LINEAR PROGRAMMING

## - DAILY LIFE EXAMPLES -

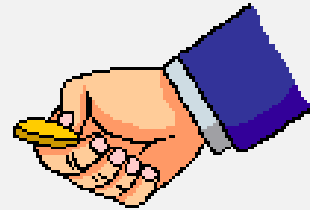
Problem	Goal/Objective + Constraint
Meal Planning	Minimize costs or calories while meeting protein/fiber needs
Packing for Travel	Maximize what you bring given the airline weight limits
Study Scheduling	Maximize exam preparedness while having limited hours per day
Party Food Planning	Maximizing guest satisfaction with minimal costs and minimal preparation time

# TRANSPORTATION PROBLEM



How to calculate the cheapest way to ship goods from B to E in view of costs and capacities ?

# FUNDAMENTALS OF MARKOV CHAINS

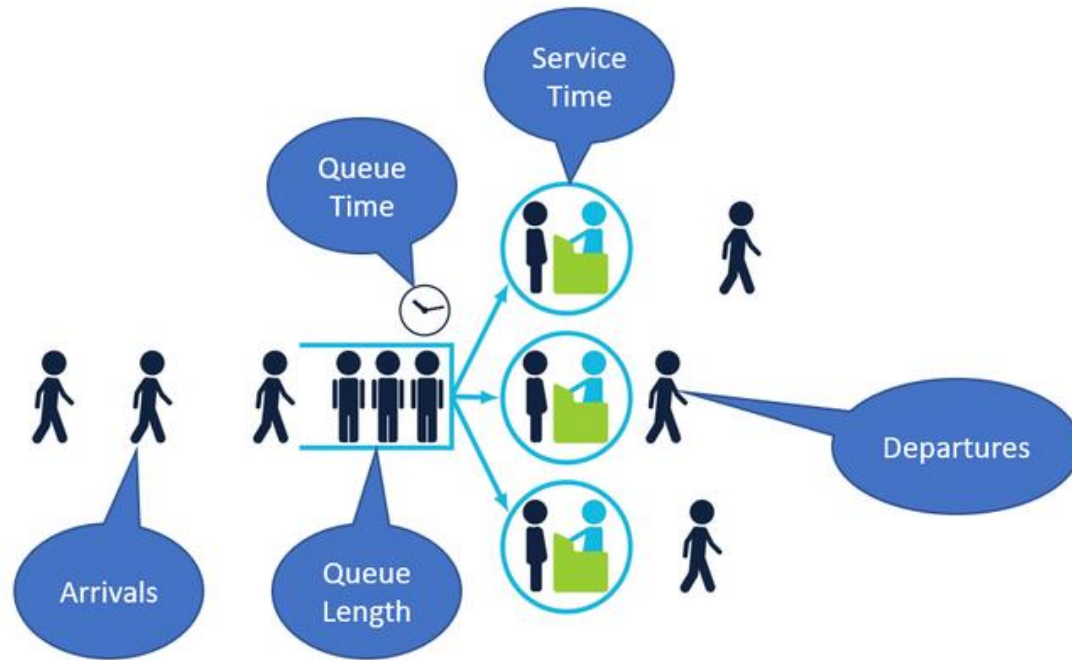


H-T-H-H-H-T-H-T-T-T-H-T-H-T-T-T-T-H-H-T

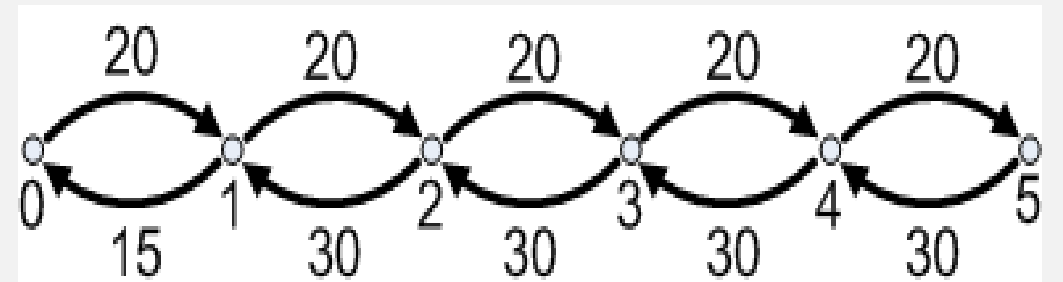
What is the expected number of coin flips until we see T-H-H-T for the first time?



# THE FUNDAMENTALS OF QUEUEING



What is the average number of customers in this model with exponential arrival/service rates?



# GAME THEORY

- STRATEGIES IN COMPETITIVE SITUATIONS -

		Friend 2	
		<i>Pizza</i>	<i>Sushi</i>
Friend 1	<i>P</i>	3 , 1	0 , 0
	<i>S</i>	0 , 0	1 , 3

How can the two friends decide what to do tonight?

# COURSE STRUCTURE

- 10 weeks spread over the semester
- 3-4 hours per week
- Material and course is in English, but we can switch to German from time to time if needed ;-)
- At the end of the course, you will be able to answer all questions of the types mentioned, and quite some other questions as well!
- BOOK: Introduction to Operations Research by Hillier and Lieberman (9th ed)
- Nice video about what is OR: [The Science of Better](#)