

## EXTERNAL COLLABORATORS

BHP Billiton; Constraint Technologies International Pty Ltd; Canadian National Centre of Excellence for Mathematics of Information Technology and Complex Systems (MITACS); CSIRO Energy Technology; Mater Hospital, Radiation Oncology Department; Hunter New England Area Health, Service, Innovation and Reform Unit; Hunter Valley Coal Chain Logistics Team; MapleSoft Inc; Mathematical Association of America; International Mathematical Union; MathResources Inc; National Institute of Standards and Technology; Sun Micro Systems.

## Using Mathematics to Maximize the Efficiency of Shared Infrastructure in Australia's Coal Export Supply Chain



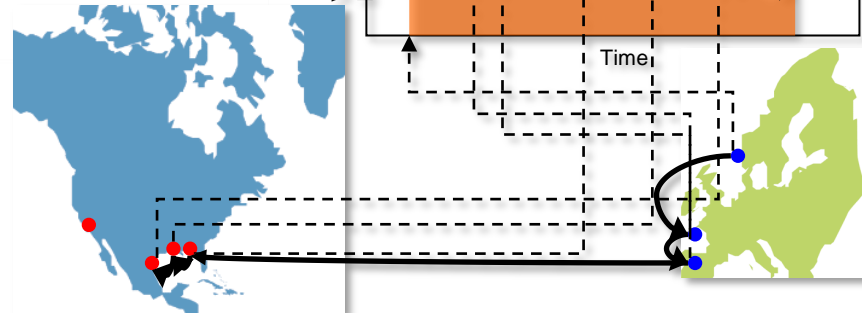
The Hunter Valley Coal Chain is the world's largest coal export terminal. And is responsible for around \$15billion in annual export income for Australia.

Members of CARMA are working closely with people from the Hunter Valley Coal Chain Logistics Team to provide a scientific basis for assessing capacity expansion options in the coal export supply chain, and assisting in the development of new planning and scheduling policies and systems that improve the operational efficiency.

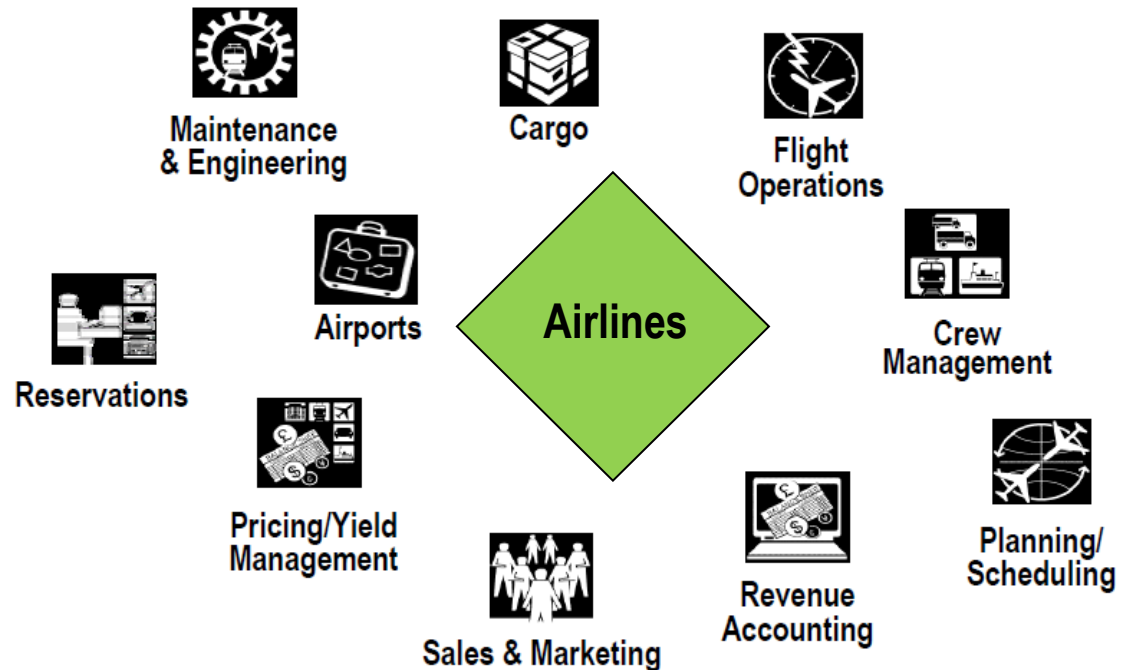


# Optimizing the Petroleum Supply Chain

$$\begin{aligned}
 & \min \sum_{v \in V} \sum_{r \in R_v} c^{v,r} \lambda^{v,r} \\
 & \text{s.t. } I_{j,t} = I_{j,t-1} + b_{j,t} - \sum_{v \in V} \sum_{r \in R_v} f_{j,t}^{v,r} \lambda^{v,r} \\
 & \quad I_{j,t} = I_{j,t-1} - b_{j,t} - \sum_{v \in V} \sum_{r \in R_v} f_{j,t}^{v,r} \lambda^{v,r} \\
 & \quad 0 \leq I_{j,t} \leq Q_{j,t}, \\
 & \quad \sum_{r \in R_v} \lambda^{v,r} = 1, \\
 & \quad \lambda^{v,r} \geq 0, \\
 & \quad \sum_{r \in R_v} z_{j,t}^{v,r} \lambda^{v,r} \in \{0, 1\},
 \end{aligned}$$



# Operations Research in the Airline Industry



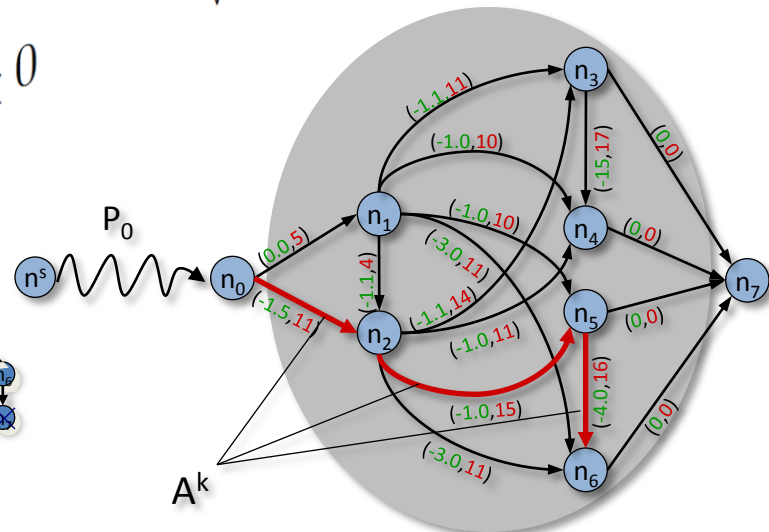
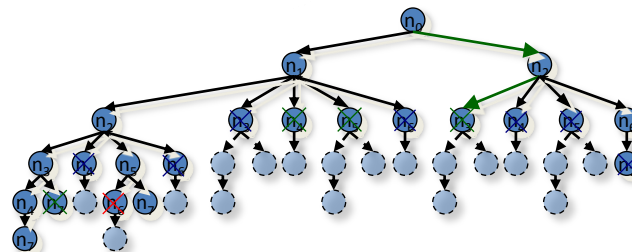
Operations Research is widely used in the airline industry. Airlines rely on software that use sophisticated mathematical techniques to run their business at both the strategic and tactical levels.

Members of CARMA are involved in many projects including revenue management, robust schedule generation, passenger demand data generation, and integrating planning for crew scheduling, aircraft routing, and aircraft maintenance.

# On-demand transportation: The Dial-a-Flight Problem



$$\begin{aligned} \min & \sum_{j \in \mathcal{J}} \sum_{P \in \bar{\mathcal{P}}} c(P) \lambda_P \\ \text{s.t.} & \sum_{j \in \mathcal{J}} \sum_{P \in \bar{\mathcal{P}}} h^r(P) \lambda_P = 1 \quad \forall r \in \mathcal{R}, \\ & \sum_{P \in \bar{\mathcal{P}}} \lambda_P = |\mathcal{J}|, \\ & \lambda_P \geq 0 \quad \forall P \in \bar{\mathcal{P}}. \end{aligned}$$





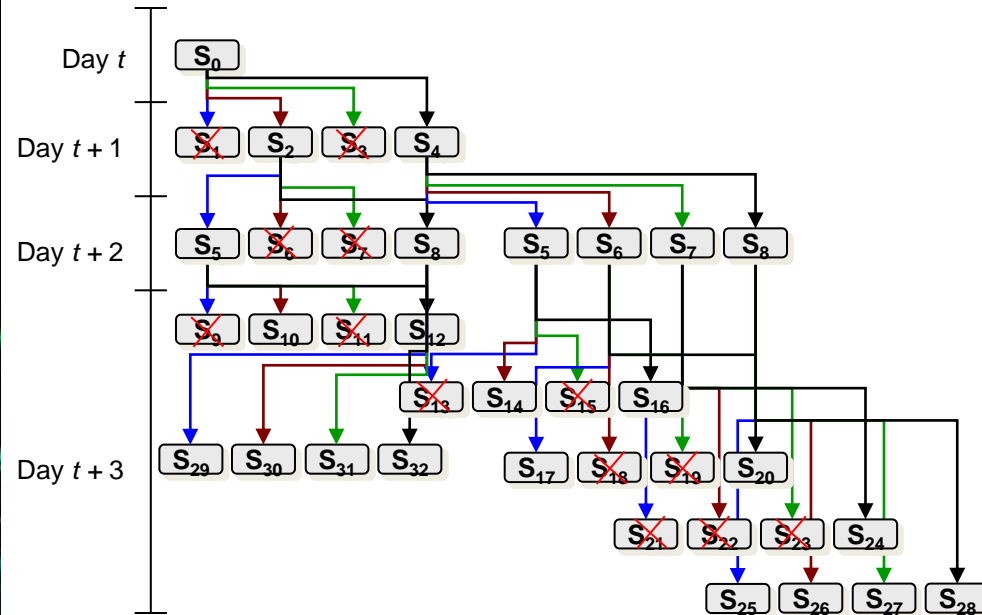
# Dynamic Pricing and Markdown Management in the Retail Industry



Retailers use operations research to dynamically change the price to maximise revenue over a fixed stock of perishable products.

Members of CARMA are involved in projects to determine the time and magnitude of the markdowns in department stores.

# Catch-up Scheduling for Childhood Vaccination



Schedule generated for: \*\*\*\*\* on Oct 27, 2007 (10/27/2007)  
Birth Date: Jun 27, 2007 (06/27/2007)

Age (weeks)	0	9	18	22	26	30	52	56	64	64	68	78	100	208	312	
Date (mm/dd/yy)	06/27/07	08/27/07	10/27/07	11/24/07	12/22/07	01/19/08	06/21/08	07/19/08	09/13/08	09/17/08	10/15/08	12/24/08	05/27/09	06/18/11	06/19/13	
HepB	AD		CD		OD											3/3
Rota																0/3
DTaP		AD	CD	PD			PD							OD		5/5
Hib		AD	CD	PD			OD									4/4
PCV		AD	CD	PD			OD									4/4
IPV			CD	CD	OD	PD										4/4
MMR							OD	PD								2/2
Var							OD*		PD							2/2
HepA							OD*						OD			2/2

AD - Administered Dose CD - Catch-up Dose OD - On-time Dose PD - Preemptive Dose

\*Dose may be administered anytime during specified interval. However, gap to subsequent doses may not be valid when administered after first day in interval.