Good Afternoon, Colleagues

Are there any questions?
Logistics

- Next week’s readings
TAC Supply Chain Management Scenario

- 6 agents are PC manufacturers
- 220 simulated game days
- suppliers and customers modeled by game server
TAC Supply Chain Management Scenario

- 6 agents are PC manufacturers
- 220 simulated game days
- suppliers and customers modeled by game server

Challenges:
- Incomplete information
- Time constraints: each simulated day lasts 15 seconds
Agents’ Daily Decisions

- Issue RFQs to suppliers
- Accept/reject supplier offers
- Plan days production mix
- Select completed orders to ship
- Bid on customer RFQs
Agents’ Daily Decisions

Day D - 1          Day D          Day D + 1

Components from suppliers  PCs to customers  Components from suppliers

Storage & Delivery

Components to production

Production

PCs from production

Production schedule (for day D)

Production schedule (for day D+1)

Production schedule (for day D+2)

Inventory

Assembly Line

The Agent

RFOs and orders to suppliers

RFOs and orders from customers

Offers to customers

RFOs and orders to suppliers

RFOs and orders from customers

Offers from suppliers

Offers to customers

Offers from suppliers

Offers from suppliers
TAC SCM Problems and Techniques

- Dynamic optimization under uncertainty
- Price prediction
- Learning and adaptivity
- Multiattribute negotiation
- Strategic bidding and procurement
- Experimental methodology
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- Dynamic optimization under uncertainty
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TAC experience has yielded contributions to AI literature on these and other topics.
Class Discussion

• Jeremy Stober on linear programming
Learning in TAC

- Travel
- SCM
A predictive agent

- Predicts customer demand: Bayesian modeling
- Predicts order probability: linear model
- Predicts supplier prices: price probes
• A **predictive** agent
  - Predicts **customer demand**: Bayesian modeling
  - Predicts **order probability**: linear model
  - Predicts **supplier prices**: price probes

• An **adaptive** agent
  - Adaptive first day ordering:  
    supply prices depend on other agents’ bids
  - Adaptive end-of-game bidding:  
    computer prices depend on other agents’ inventory
TacTex-05 overview

Supplier Model

Supply Manager
send RFQs to suppliers
accept supplier offers

Demand Manager
bid on customer RFQs
produce and deliver computers

Demand Prediction
Offer Acceptance Prediction

projected inventory and costs
projected component use
TacTex-05 results

- Won the seeding round, but that's no guarantee
TacTex-05 results

- Won the seeding round, but that’s no guarantee
- Won the finals too! Adaptation evident
TacTex-05 results

- Won the seeding round, but that’s **no guarantee**
- Won the finals too! **Adaptation** evident
- **Controlled testing** in progress
Bidding for Customer Orders

Customers send Requests for Quotes (RFQs) consisting of:
Bidding for Customer Orders

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- the **type** of computer desired (1 of 16 types)
- the **quantity** of computer desired (1 – 20)
- the **due date** (3 – 12 days in the future)
- a **reserve price** indicating the maximum the customer will pay
- a **penalty** that must be paid for each day the delivery is late
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Agents submit **sealed bids**; customers accept lowest offers

Daily reports indicate yesterday’s high and low prices
The Bidding Problem

What bids should an agent place on the RFQs it receives each day?
The Bidding Problem

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Our approach:

- bid on a large number of RFQs in hopes of winning some fraction
- BUT avoid receiving more orders than can be filled
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This requires:

- a method of predicting the probability of winning with a certain bid
- a means of using these predictions to maximize expected profit
Learning Bid Acceptance Probabilities

Problem: given the attributes of an RFQ and knowledge of the game conditions, predict the probability of winning the order as a function of the price bid - a conditional density estimation problem.
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We take an approach used previously in a different TAC scenario: (Schapire, Stone, McAllester, Littman, and Csirik 2002)

- Divide the price range into several bins
- Train a separate predictor for each endpoint with a regression learner
- Interpolate to derive a function