Good Afternoon, Colleagues

Are there any questions?
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- Persistent vs. normal weak achievement goals
Logistics

• Programming assignment 4 - any questions?
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• Final project
Logistics

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- Scheduled exam time: Friday 5/13, 2–5pm
Logistics

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- Final project
- Scheduled exam time: Friday 5/13, 2–5pm
- CMU Roadshow: Monday 2/21, 5pm (refreshments 4:30)
Soccer server communication

- What is the soccer server communication protocol?
- Does an ACL make sense in the soccer server? If so, under what circumstances?

An example protocol
CYC – Doug Lenat

- Attempt to program common sense
CYC – Doug Lenat

• Attempt to program common sense

• > 1 million rules
  – “Trees are usually outdoors.”
  – “Once people die they stop buying things.”
  – “Glasses of liquid should be carried rightside-up.”
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- Potential applications?
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- Ongoing effort since 1984

- Potential applications?
  - Some listed on their web site
  - Question answering, retrieval of captioned information, machine translation, speech recognition, semantic data mining, . . .
Joint Intentions – Setting

How agents **form and disband** teams
Joint Intentions – Setting

How agents **form and disband** teams

- Agents in dynamic multiagent world
- Neither complete nor correct beliefs
- Changeable goals, fallible actions
- Don’t know others’ beliefs/goals
Starting Point – Individuals

Persistent goal: relative to $q$ to achieve $p$
Starting Point – Individuals

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- $p$ false, but desired true
- $p$ will keep being desired unless:
Starting Point – Individuals

**Persistent goal**: relative to $q$ to achieve $p$

- $p$ false, but desired true
- $p$ will keep being desired unless:
  - $p$ true
  - $p$ impossible
  - $q$ false
Starting Point – Individuals

**Persistent goal:** relative to \( q \) to achieve \( p \)

- \( p \) false, but desired true
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**Intention:** persistent goal, belief throughout that it’s being done
Persistent goal: relative to $q$ to achieve $p$

- $p$ false, but desired true
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Intention: persistent goal, belief throughout that it’s being done

- What’s the role of $q$?
Starting Point – Individuals

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**Intention:** persistent goal, belief throughout that it’s being done

- What’s the role of $q$?
- What’s the difference between goal, intention?
2 proposals for teams

Joint commitment not just intention where agent is team
2 proposals for teams

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**Weak**: Joint intention $\equiv$ mutually known intention: each intend to do their part of collective action
2 proposals for teams

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**Strong:** Same, except mutual knowledge persists until mutually known that activity is over
2 proposals for teams

Joint commitment not just intention where agent is team

Weak: Joint intention $\equiv$ mutually known intention: each intend to do their part of collective action

Strong: Same, except mutual knowledge persists until mutually known that activity is over

Why too weak and too strong?
Joint Commitment

Weak achievement goal (WAG): relative to $q$ with respect to a team to achieve $p$
Joint Commitment

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- Individually wants $p$
Joint Commitment

Weak achievement goal (WAG): relative to $q$ with respect to a team to achieve $p$

- Individually wants $p$
- OR
- Believes $p$ true, impossible, or irrelevant, AND has a goal of team knowing it.

4 cases
Joint Commitment

Joint Persistent Goal (JPG): relative to $q$ to achieve $p$

- mutually believe $p$ false, but mutually know all desire $p$ true
- mutually believe that each have WAG $p$ until
  - mutually believe $p$ true
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- Intend own action, committed to others’
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- Intend own action, committed to others’

- Overhead: automatic goal to communicate status
Establishing JPGs

- Communication (basis for KQML)
- Observation (requires co-presence)
Establishing JPGs

- Communication (basis for KQML)
- Observation (requires co-presence)
- Any other way?
Locution: What is said (physical)
Locution: What is said (physical)

Illocution: What is meant
Locution: What is said (physical)

Illocution: What is meant

Perlocution: Intended effects
Locution: What is said (physical)

Illocution: What is meant

Perlocution: Intended effects

Example: “Please close the window.”
Beliefs, Desires, Intentions

- Beliefs: What the agent thinks to be true
- Desires: What it wants to be true
- Intentions: What it plans to do
Beliefs, Desires, Intentions

- **Beliefs**: What the agent thinks to be true
- **Desires**: What it wants to be true
- **Intentions**: What it plans to do
- A way of organizing an agent
- Not a well-defined method
“Capabilities for teamwork cannot be patched on, but must be designed in from the start.” (Grosz, 1996)
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● Agree or disagree?
STEAM

- An implementation/extension of joint intentions

- Goals
  - Anticipate teamwork failures
  - Flexibility and re-use
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• Joint intentions doesn’t do it all, though
STEAM

• An implementation/extension of joint intentions

• Goals
  – Anticipate teamwork failures
  – Flexibility and re-use

• Joint intentions doesn’t do it all, though
  – Coherence: all use same plan, commitment protocols
  – Communication cost — decision theoretic
  – Replanning — role dependencies
Team Operators

- Have preconditions, effects, termination rules
- Automatically establish joint intentions
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- To establish, “all team members must simultaneously select” a team operator to establish a joint intention
- Agents maintain “team state:” model of team’s mutual beliefs
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Domains

● Attack:
  – Fly to holding point
  – Send out scouts
  – Shoot at enemy

● Transport:
  – Escorts protect transports

● RoboCup
Observed Problems

- Commander returns to home alone after failing, others stayed
Observed Problems

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- Scout never returned, others got into infinite loop
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Solved generally with STEAM
Evaluation

- Used in 3 domains with different characteristics
Evaluation

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- STEAM rules can be re-used
- Flexibility: solves initial problems, can deal with small changes to environment
Evaluation

- Used in 3 domains with different characteristics
- STEAM rules can be re-used
- Flexibility: solves initial problems, can deal with small changes to environment
- Communication efficiency
- Encoding and modification effort