

# Agent Architectures

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BE4M36MAS - Multiagent systems

# Organization

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# Distant Teaching

- Active participation still expected!
- Don't be afraid to ask
  - Un-mute and speak, that's it.
  - You can use the chat if you are shy.
- Preferably, connect with video.



David Fiedler (Tutorial 1–3)	david.fiedler@agents.fel.cvut.cz
Dominik Andreas Seitz	seitzdom@fel.cvut.cz
Michal Šustr	michal.sustr@aic.fel.cvut.cz
Aditya Aradhya (Tutorial 12–14)	

Website:

*<https://cw.fel.cvut.cz/wiki/courses/be4m36mas/start>*

## Agent Programming

22 Sept	Introduction to multi-agent systems	Pěchouček
29 Sept	Agent Architectures. Belief-Desire-Intention architecture	Pěchouček/Jakob

## Non-cooperative Game Theory

6 Oct	Introduction to Game Theory	Bošanský
13 Oct	Solving Normal-form Games	Bošanský
20 Oct	Games in Extensive Form	Bošanský
27 Oct	Solving Extensive-Form Games	Bošanský
3 Nov	Other Game Representations	Bošanský

## Multiagent Resource Allocation

10 Nov | Multiagent Resource Allocation

| Jakob

## Auctions

24 Nov	Auctions 1	Jakob
1 Dec	Auctions 2	Jakob



## Coalitional Game Theory

8 Dec	Coalitional Game Theory 1	Kroupa
15 Dec	Coalitional Game Theory 2	Kroupa
22 Dec	Coalitional Game Theory 3	Kroupa

## Social Choice, Voting

5 Jan | Social Choice, Voting

| Kroupa

Attendance: **voluntary** (but tracked)

Assessment – 3 assignments:

1. Agent programming (max 14 pts)
2. Game theory (max 14 pts)
3. Coalitional game theory (12 pts)

You have to obtain at least 20 points. Plagiarism is strictly forbidden (Strong punishments would be applied).

# Agent architectures

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# Components of agent architectures

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## Actions ( $A$ )

Ways for the agent to influence the environment

## Percepts ( $P$ )

Observations about the state of the world

## Decision making ( $d : P^* \rightarrow A$ )

Mapping perception history to actions

# Architecture types

1. Reflex (reactive) Agent
2. Model-based Reflex Agent
3. Model-based Goal-based Agent
4. Model-based Utility-based Agent
5. Learning-based Agent

(Russell and Norvig)

Let's Play with Agents!

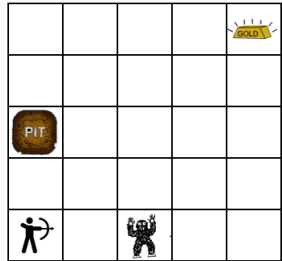
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# Wumpus' World

## Wumpus' World

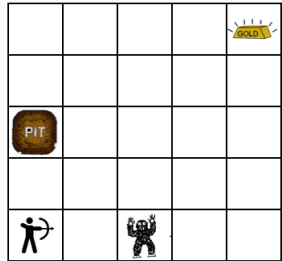
- Grid world environment
- Agent has to find the gold brick and carry it to the bottom left square
- Problem: Entering a square occupied by Wumpus or containing a pit costs agent his life (Wumpus does not move)



# Wumpus' World

## Wumpus' World — Percepts

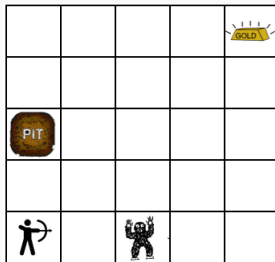
- *Breeze* — whenever agent stands next to a pit
- *Stench* — whenever agent stands next to Wumpus
- *Gold* — when agent carries a gold brick



# Wumpus' World

## Wumpus' World — Actions

- Going to any neighboring square (only vertically and horizontally)



# Reflex agent

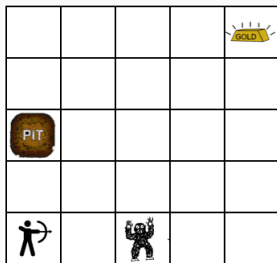
Agent conditions his decision solely on his **current** percepts.  
(e.g. on the facts he can currently sense)

*Task: Implement a reflex agent for Wumpus world. Beware, do not use any kind of memory or smarter reasoning ;-)*

## Model-based reflex agent

Agent uses percepts to gradually build a **model** of the environment.

Decisions are based on the expected state of the world according to his model.



*Question: Does this approach allow us to overcome this issue?*

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Agent uses percepts to gradually build a **model** of the environment.

Decisions are based on the expected state of the world according to his model.



*Question: Does this approach allow us to overcome this issue?*

*Task: Implement a model-based agent and reach the gold!*

## Model-based reflex agent

*Question: Is the behaviour of the agent rational?*

## Model-based reflex agent

*Question: Is the behaviour of the agent rational?*

**Definitely not!**

Agent just exploits the model to stay alive. He does not intentionally pursue his goal.



# Model-based Goal-based agent

Actions are chosen in order to reach a **declaratively** specified goal.

Techniques:

1. Planning

Planning in AI

2. Belief-Desire-Intention Architecture

this course

*Question: What does it mean for an agent in Wumpus' world?*

# Model-based Utility-based agent

Not all ways to reach the goal are equally plausible. Some ways to reach the goal **should be preferred** against others. (e.g. cheaper or less risky ones)

Utility driven sequential decision making:

- Non-adversarial: MDPs, POMDPs
- Adversarial: Sequential games

Planning in AI  
this course

## Learning-based agent

Agent **does not fully know** the task he is facing.  
(what his action does, what is his goal etc.)

He **learns** the task on the go — strategy reflecting these finds cannot be fixed in advance.

Learning **both** model and strategy.

Next tutorial

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- Belief-Desire-Intention architecture