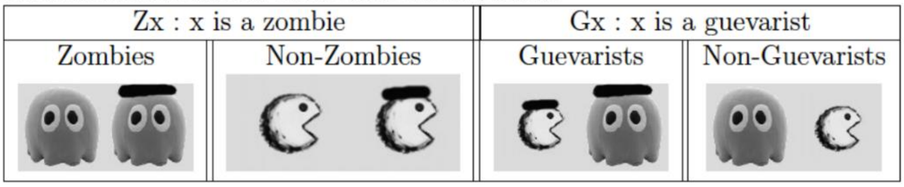
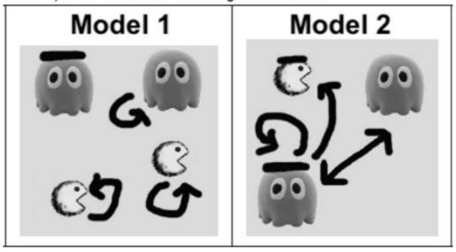
First Order Logic
Consider a world full of Zombies and Guevarists. Here is what they look like:



Lxy means that x likes y. This is indicated by an arrow (arrows point from the first argument of the predicate, the one who likes, to the second, the one who is liked). Consider the following two models:



For each formula below decide if it distinguishes the two models, in other words, if the formula is true in one of the models and false in the other one. (15%)

Choose one option for each line

	Yes	No
$\forall x(Gx \to Lxx)$	✔	○
$\forall x(Zx \to \exists y Lxy)$	✔	○
$\forall x \forall y \forall z((Lxy \land Lyz) \to Lxz)$	✔	○
$\exists x Lxx$	○	✔
$\forall x(\exists y Lxy \to \exists z Lzx)$	○	✔

Ikke i eksamen

Belief Revision
Answer the following questions about belief revision.

Is it the case that $\neg p \in Cn(\{q, p \land \neg q\})$? (3%)

Choose one answer

○ No

✔ Yes

???

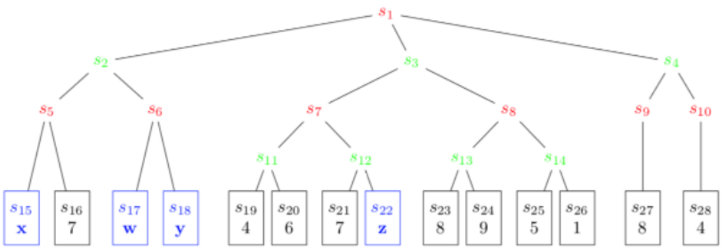
Let $A = \{p, q, p \lor q, p \to q, \neg p \to q\}$ be a belief base. Which of the following sets are in $A \perp q$? (20%)

Choose one option for each line

	Yes	No
$\{p, \neg q, p \lor q, \neg p \to q\}$	✔	○
$\{p, p \lor q, p \to q, \neg p \to q\}$	○	✔
$\{p, p \lor q, \neg p \to q\}$	○	✔
$\{p, p \lor q\}$	○	✔
$\{p \lor q, p \to q, \neg p \to q\}$	○	✔

Solve with remainder_finder_final

Adversarial Search



Consider the game-tree above. The maximising player controls red nodes and the minimising player controls the green ones.

It is known that $MINIMAX(s_1) = 7$. Decide which of the following assignment of values to x, w, y, z are possible in such case. (9%)

Choose one option for each line

	Yes	No
$x := 8, w := 8, y := 9, z := 8$	○	✓
$x := 6, w := 5, y := 6, z := 8$	✓	○
$x := 6, w := 8, y := 6, z := 6$	✓	○

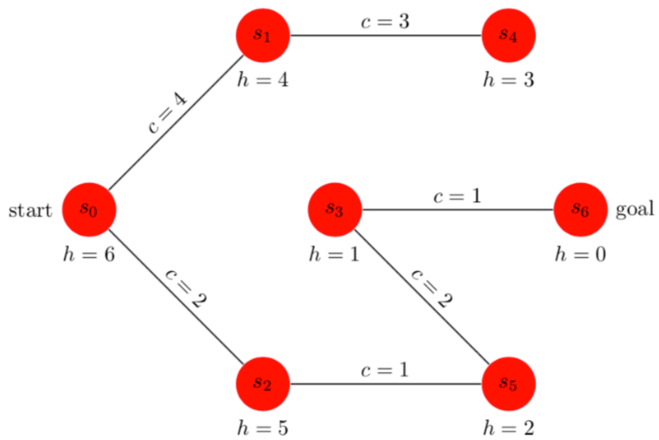
For each of the following assignments of values to x, w, y, z decide if under those assignments Alpha-Beta search explores all states of the game-tree. (9%)

Choose one option for each line

	Yes	No
$x := 6, w := 8, y := 6, z := 6$	○	✓
$x := 8, w := 7, y := 9, z := 8$	○	✓
$x := 6, w := 5, y := 6, z := 8$	○	✓

Løst med minimax script

Informed Search



Consider the state space in figure above. Heuristic function for each node is given by h and the step-costs are given by c. All transitions are bidirectional. You are asked to answer questions about the run of various tree and graph search algorithms on this space.

Evaluate the following statement:
Greedy Best-First Tree Search expands node s_5. (3%)

Choose one answer

True

False

Alle løst med Graph Search script

Evaluate the following statement:
Greedy Best-First Graph Search expands node s_2. (3%)

Choose one answer

- False
- True

Evaluate the following statement:
Uniform Cost Graph Search expands node s_4. (3%)

Choose one answer

- False
- True

Evaluate the following statement:
A^*Tree Search expands node s_1. (3%)

Choose one answer

- True
- False

Evaluate the following statement:
A^*Graph Search expands node s_1.(3%)

Choose one answer

- True
- False

Evaluate the following statement:
A^*Graph Search expands node s_1.(3%)

Choose one answer

- True
- False

Evaluate the following statement:
Greedy Best-First Tree Search expands node s_3. (3%)

Choose one answer

- True
- False

Evaluate the following statement:
Uniform Cost Tree Search expands node s_4. (3%)

Choose one answer

- False
- True

Partial Observability

Consider the following partially observable domain. An agent is in a room that contains a light bulb and a coin. There are four possible physical states:

- ***light_on_heads_up*** : the light bulb is **on** and the coin is laying **heads up**.
- ***light_on_tails_up***: the light bulb is **on** and the coin is laying **tails up**.
- ***light_off_heads_up*** : the light bulb is **off** and the coin is laying **heads up**.
- ***light_off_tails_up***: the light bulb is **off** and the coin is laying **tails up**.

There is one action available:

- ***turn_light_on*** : the agent can turn the light bulb on, if it is currently off

The ACTIONS and RESULTS functions are defined as follows:

- ACTIONS(***light_off_heads_up***) = ACTIONS(***light_off_tails_up***) = {***turn_light_on***}
- ACTIONS(***light_on_heads_up***) = ACTIONS(***light_on_tails_up***) = { }
- RESULTS(***light_off_heads_up*** , ***turn_light_on***) = {***light_on_heads_up***}
- RESULTS(***light_off_tails_up turn_light_on***) = {***light_on_tails_up***}

The agent can only see whether the coin is laying heads up or tails up, if the light is currently on. Formally, the PERCEPT function is as follows:

- PERCEPT(***light_on_heads_up***) = ***heads_up_visible***
- PERCEPT(***light_on_tails_up***) = ***tails_up_visible***
- PERCEPT(***light_off_heads_up***) = PERCEPT(***light_off_tails_up***) = *null*

Suppose that the agent's initial belief state is *b* = {***light_off_heads_up, light_off_tails_up***}.

What is $\text{POSSIBLE-PERCEPTS}(\bigcup_{s \in b} \text{RESULTS}(s, turn\_light\_on))$? (3%)

Choose one answer

- [ ] {{*null* }, {***heads_up_visible,tails_up_visible*** }}
- [ ] {*null* }
- [ ] {*null*, ***heads_up_visible,tails_up_visible***}
- [x] {***heads_up_visible, tails_up_visible***}

Propositional Logic

Consider this numbered list of formulas:

- $(\neg p \vee q) \vee (\neg q \vee p)$
- $p \wedge \neg p$
- $(p \vee q) \wedge (p \vee \neg q)$
- $p \vee q \vee q$

Which of the above formulas match the following descriptions? (12%)

Choose one option for each line

	1	2	3	4
unsatisable conjunction of Horn clauses	○	●	○	○
valid disjunction of denite clauses	●	○	○	○
equivalent to p	○	○	●	○
result of resolving $p \vee q \vee r$ and $\neg r \vee q$	○	○	○	●