

Q1A. The **FESTIMO syllogism** is as follows:

$$\forall x. B(x) \rightarrow \neg A(x)$$

$$\underline{\exists x. C(x) \wedge A(x)}$$

$$\exists x. C(x) \wedge \neg B(x)$$

Is it sound? Prove your answer with resolution! Take care of the Skolemization. (8 points)

Q2A. What is the type of the next statement: valid, satisfiable, not satisfiable, none of these. Prove your answer with truth tables. (5 points)

$$(A \rightarrow \neg B) \rightarrow (C \rightarrow B).$$

Q3A. Define the **completeness** of a proof method! (5 points)

Q4A. In a simple world a **Card(c)** can be **TurnedUp(c,s)** or **TurnDown(c,s)**, which can be changed by the **Flip** operator or leave unchanged by the operator **DoNothing**. Define a successor-state axiom in situation calculus for the **TurnedUp** state. (8 points)

Q5A. Apply the algorithm **A*** from A to B and fill the cells according to the scheme on the right (**h** the value of heuristic, **g** denotes the minimal cost of the path, **f** is the total cost, and **a** is the altitude of the cell). The applied heuristics is the Manhattan distance (minimum number of steps using only the four neighbours). The real cost to a neighbouring cell is **1 + Δ**, where **Δ** is the distance between the altitudes if we step to higher place, otherwise **Δ** is 0. Indicate the optimal path on the map! (12 points)

Q6A. What is an empty plan? Give a formal description and an example. (12 points)

Q7A. What is the best search method, if we have no heuristic function, a priori knowledge about the depth of the solution, and the state space is infinite? Why (what are the properties)? (5 points)

Q8A. Define the diagrams of the **reflex** and the **goal-oriented** agents. (5 points)

0	0	0	2	0
0 A	1	1	2	0
0	0	0	2	0
0	0	0	2	0
1	1	1	2	0 B
0	0	0	2	0

h	g
m	f