UNIVERSITY OF INNSBRUCK
MASTERSTUDIUM INFORMATIK VERTIEFUNGSMODUL (WM 9)
Automatic Planning
Lecturer: Jörg Hoffmann
Tutor: Adina Sirbu
Exercises Nr. 9. **To be returned on Tuesday, Jan 8**

Exercise 1. (7=2+3+2 points)

Consider the following Simple-TSP task. The set of facts is $P = \{at(l_1), at(l_2), at(l_3), at(l_4), at(l_5), visited(l_1), visited(l_2), visited(l_3), visited(l_4), visited(l_5)\}$. The initial state is $I = \{at(l_1)\}$. The goal is $G = \{visited(l_1), visited(l_2), visited(l_3), visited(l_4), visited(l_5)\}$. The set of actions is $A = \{visit(x, y) \mid 1 \leq x \neq y \leq 5\}$ where $visit(x, y) = (\{at(x)\}, \{at(y), visited(y)\}, \{at(x)\})$.

1. Are there dead ends? Prove your answer, using as much as possible the lemmas in "Local Search Topology", slides 53–63.
2. Are there local minima under h^+? Prove your answer, using as much as possible the lemmas in "Local Search Topology", slides 53–63.
3. What is the maximal exit distance under h^+? Prove your answer, not necessarily using the terminology on the slides.

Note: Both 1. and 2. *can* be proved using lemmas from the lecture. If you do not use those lemmas, then points will be subtracted.

Exercise 2. (3 points)

Prove hardness in the theorem on "Local Search Topology" slide 52, i.e., prove PSPACE-hardness of DEAD-END. Tip: There is a very simple proof that goes via a reduction from PLANSAT ("Planning Formalisms", slide 27); given an arbitrary STRIPS task (P, A, I, G), you can modify that task to (P', A', I', G') in a way so that (P', A', I', G') contains a dead end iff (P, A, I, G) is unsolvable.