

*AI principles and approaches*

**Exam - Correction**

**Exercise 1: 10 pts**

1) Define in your own word the terms: **agent** and **rationality**.

**Agent**- A system with at least some form of intelligence. *1pts*

**A Rational agent** must perform the action that maximizes its measure of performance according to its perception of the world and its knowledge. *1pts*

2) iRobot Roomba is the vacuum cleaner shown in the photo :

- Give a PEAS description for it.

\_ **Performance:** cleanness, efficiency: distance travelled to clean, battery life, security.

*1pts*

\_ **Environment:** room, table, wood floor, carpet, different obstacles. *1pts*

\_ **Actuators:** wheels, different brushes, vacuum extractor. *1pts*

\_ **Sensors:** camera, dirt detection sensor, cliff sensor, bump sensors, infrared wall sensors.

*1pts*

- Characterize it in terms of the following properties: Observable, Deterministic, Static, Discrete, Agents.

*Partially Obs. Stochastic, Dynamic, Continuous, Single Agent. 2.5pts*

- Is this vacuuming cleaning agent rational?

Yes, considering the defined performance measures, its perceptions and its actuators, the agent is indeed rational. *1.5pts*

**Exercise 2: 10 pts**

Mushrooms of various types grow widely all over area x. Some of the mushrooms have been determined as poisonous and others as not. You have the following data to consider:

Example	NotHeavy	Smelly	Spotted	Smooth	Edible
<b>A</b>	1	0	0	0	1
<b>B</b>	1	0	1	0	1
<b>C</b>	0	1	0	1	1
<b>D</b>	0	0	0	1	0
<b>E</b>	1	1	1	0	0
<b>F</b>	1	0	1	1	0
<b>G</b>	1	0	0	1	0
<b>H</b>	0	1	0	0	0
<b>U</b>	0	1	1	1	?
<b>V</b>	1	1	0	1	?
<b>W</b>	1	1	0	0	?

- a) Which attribute should you choose as the root of a decision tree between **NotHeavy** and **Smooth**? **3pts**

$$\begin{aligned}
 \text{Remainder}_{\text{NotHeavy}} &= \frac{5}{8} \left( -\frac{2}{5} \log_2 \frac{2}{5} - \frac{3}{5} \log_2 \frac{3}{5} \right) + \frac{3}{8} \left( -\frac{1}{3} \log_2 \frac{1}{3} - \frac{2}{3} \log_2 \frac{2}{3} \right) \\
 &\cong 0.9512
 \end{aligned}$$

$$\text{Remainder}_{\text{Smooth}} = \frac{4}{8} \left( -\frac{1}{4} \log_2 \frac{1}{4} - \frac{3}{4} \log_2 \frac{3}{4} \right) + \frac{4}{8} \left( -\frac{2}{4} \log_2 \frac{2}{4} - \frac{2}{4} \log_2 \frac{2}{4} \right) \cong 0.9056$$

Choose **Smooth** for first split since it minimizes the remaining information needed to classify all examples.

- b) Build a decision tree to classify mushrooms as poisonous or not, figure this out by looking at the data without explicitly computing the information gain of the rest of the attributes (**explain**). **3.5 pts**

*You can notice that the attribute **smelly** is accurately decisive:*

When **smooth** equal to **1**: **1 smelly = 1**  $\Rightarrow$  **edible = 1**

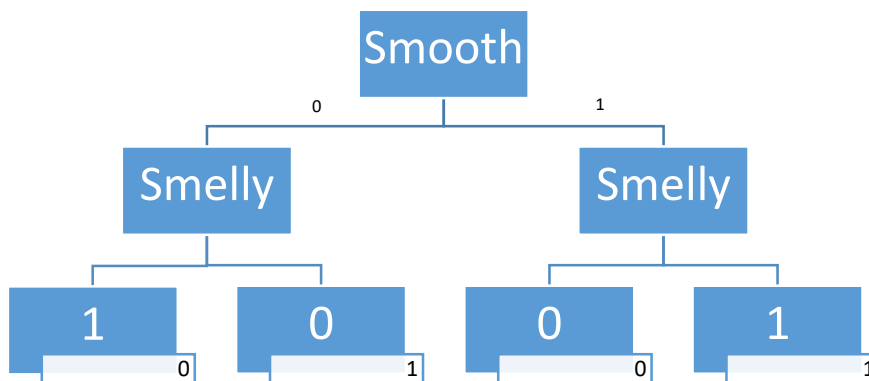
**3 smelly = 0**  $\Rightarrow$  **edible = 0**

When **smooth** equal to **0**: **2 smelly = 1**  $\Rightarrow$  **edible = 0**

**2 smelly = 0**  $\Rightarrow$  **edible = 1**

*Then: we can use **smelly** as the leaf node to create a **decision tree**.*

**2pts**



- c) Classify mushrooms U, V and W using the decision tree as poisonous or not poisonous. **1.5pts**

**U:** Smooth = 1, Smelly = 1  $\Rightarrow$  **Edible = 1**

**V:** Smooth = 1, Smelly = 1  $\Rightarrow$  **Edible = 1**

**W:** Smooth = 0, Smelly = 1  $\Rightarrow$  **Edible = 0**