Introduction into Artificial Intelligence

Mid-term 1. – Group A

We have 13 apples, 46 pears and 59 oranges. We can trade in 1 of two different fruits to get 2 of the third one (ex. 1 apple + 1 pear = 2 oranges) at the market. By performing these kinds of trades, our goal is to have only one type of fruit.

1. **Description:**

   $H_1 \in \mathbb{N}; \quad H_2 \in \mathbb{N}; \quad H_3 \in \mathbb{N}$

   $where\ \mathbb{N} = \{0, 1, 2, 3, \dots\};$

   $H_1\ is\ the\ number\ of\ apples$

   $H_2\ is\ the\ number\ of\ pears$

   $H_3\ is\ the\ number\ of\ oranges$

2. **Set of valid states:**

   $S = H_1 \times H_2 \times H_3$

3. **Initial state:**

   $s_0 = < 13, 46, 59 >$

4. **Set of goal states:**

   $$G = \left\{ < a_1, a_2, a_3 > \middle| \begin{matrix} < a_1, a_2, a_3 > \in S \\ \wedge\ (a_1 + a_2 = 0 \ \vee\ a_1 + a_3 = 0 \ \vee\ a_2 + a_3 = 0) \end{matrix} \right\}$$

5. **Set of operators:**

   $O = \{ o_{i,j} | i \in \{1, 2, 3\} \wedge j \in \{1, 2, 3\} \wedge i \neq j \}$

   $(i\ and\ j\ will\ be\ the\ fruits\ that\ we\ are\ trading)$

6. **Domain of operators:**

   $dom(o_{i,j}) = \{ < a_1, a_2, a_3 > | < a_1, a_2, a_3 > \in S \wedge a_i > 0 \wedge a_j > 0 \}$

   $(check\ if\ we\ have\ fruit\ to\ trade)$

7. **Effect definition (transition function):**

   $o_{i,j}(< a_1, a_2, a_3 >) = < b_1, b_2, b_3 >$

   $$\begin{matrix} b_k \\ k \in \{1, 2, 3\} \end{matrix} \begin{cases} a_k - 1 & if\ k = i \vee k = j \\ a_k + 2 & else \end{cases}$$