

Logic and the Wumpus World

Pit and breeze rules

Define the rules

```
In[82]:= (p0 = ¬ Breeze[s] ⇒ ¬ Breezy[s]) // TraditionalForm
(p1 = Breeze[s] ⇒ Breezy[s]) // TraditionalForm
(p2 = Breezy[s] ⇒ (Pit[North[s]] ∨ Pit[South[s]] ∨ Pit[East[s]] ∨ Pit[West[s]])) //
TraditionalForm
(p3 = ¬ Breezy[s] ⇒ (¬ Pit[North[s]] ∧ ¬ Pit[South[s]] ∧
    ¬ Pit[East[s]] ∧ ¬ Pit[West[s]])) // TraditionalForm
(p4 = (Breezy[s] ∧ Pit[North[s]] ∧ Pit[South[s]] ∧ Pit[East[s]]) ⇒ Pit[West[s]]) //
TraditionalForm
(p5 = (Breezy[s] ∧ Pit[North[s]] ∧ Pit[South[s]] ∧ Pit[West[s]]) ⇒ Pit[East[s]]) //
TraditionalForm
(p6 = (Breezy[s] ∧ Pit[North[s]] ∧ Pit[East[s]] ∧ Pit[West[s]]) ⇒ Pit[South[s]]) //
TraditionalForm
(p7 = (Breezy[s] ∧ Pit[South[s]] ∧ Pit[East[s]] ∧ Pit[West[s]]) ⇒ Pit[North[s]]) //
```

```
Out[82]//TraditionalForm=
¬ Breeze(s) ⇒ ¬ Breezy(s)
```

```
Out[83]//TraditionalForm=
Breeze(s) ⇒ Breezy(s)
```

```
Out[84]//TraditionalForm=
Breezy(s) ⇒ Pit(North(s)) ∨ Pit(South(s)) ∨ Pit(East(s)) ∨ Pit(West(s))
```

```
Out[85]//TraditionalForm=
¬ Breezy(s) ⇒ ¬ Pit(North(s)) ∧ ¬ Pit(South(s)) ∧ ¬ Pit(East(s)) ∧ ¬ Pit(West(s))
```

```
Out[86]//TraditionalForm=
Breezy(s) ∧ Pit(North(s)) ∧ Pit(South(s)) ∧ Pit(East(s)) ⇒ Pit(West(s))
```

```
Out[87]//TraditionalForm=
Breezy(s) ∧ Pit(North(s)) ∧ Pit(South(s)) ∧ Pit(West(s)) ⇒ Pit(East(s))
```

```
Out[88]//TraditionalForm=
Breezy(s) ∧ Pit(North(s)) ∧ Pit(East(s)) ∧ Pit(West(s)) ⇒ Pit(South(s))
```

```
Out[89]//TraditionalForm=
Breezy(s) ∧ Pit(South(s)) ∧ Pit(East(s)) ∧ Pit(West(s)) ⇒ Pit(North(s))
```

Convert to CNF

```
In[90]:= (p0$cnf = BooleanConvert[p0, "CNF"]) // TraditionalForm
(p1$cnf = BooleanConvert[p1, "CNF"]) // TraditionalForm
(p2$cnf = BooleanConvert[p2, "CNF"]) // TraditionalForm
(p3$cnf = BooleanConvert[p3, "CNF"]) // TraditionalForm
(p4$cnf = BooleanConvert[p4, "CNF"]) // TraditionalForm
(p5$cnf = BooleanConvert[p5, "CNF"]) // TraditionalForm
(p6$cnf = BooleanConvert[p6, "CNF"]) // TraditionalForm
(p7$cnf = BooleanConvert[p7, "CNF"]) // TraditionalForm

Out[90]//TraditionalForm=
Breeze(s)  $\vee$   $\neg$  Breezy(s)

Out[91]//TraditionalForm=
 $\neg$  Breeze(s)  $\vee$  Breezy(s)

Out[92]//TraditionalForm=
 $\neg$  Breezy(s)  $\vee$  Pit(East(s))  $\vee$  Pit(North(s))  $\vee$  Pit(South(s))  $\vee$  Pit(West(s))

Out[93]//TraditionalForm=
(Breezy(s)  $\vee$   $\neg$  Pit(East(s)))  $\wedge$  (Breezy(s)  $\vee$   $\neg$  Pit(North(s)))  $\wedge$ 
(Breezy(s)  $\vee$   $\neg$  Pit(South(s)))  $\wedge$  (Breezy(s)  $\vee$   $\neg$  Pit(West(s)))

Out[94]//TraditionalForm=
 $\neg$  Breezy(s)  $\vee$   $\neg$  Pit(East(s))  $\vee$   $\neg$  Pit(North(s))  $\vee$   $\neg$  Pit(South(s))  $\vee$  Pit(West(s))

Out[95]//TraditionalForm=
 $\neg$  Breezy(s)  $\vee$  Pit(East(s))  $\vee$   $\neg$  Pit(North(s))  $\vee$   $\neg$  Pit(South(s))  $\vee$   $\neg$  Pit(West(s))

Out[96]//TraditionalForm=
 $\neg$  Breezy(s)  $\vee$   $\neg$  Pit(East(s))  $\vee$   $\neg$  Pit(North(s))  $\vee$  Pit(South(s))  $\vee$   $\neg$  Pit(West(s))

Out[97]//TraditionalForm=
 $\neg$  Breezy(s)  $\vee$   $\neg$  Pit(East(s))  $\vee$  Pit(North(s))  $\vee$   $\neg$  Pit(South(s))  $\vee$   $\neg$  Pit(West(s))
```

Construct knowledge base



```
In[98]:= kb = p0$cnf  $\wedge$  p1$cnf  $\wedge$  p2$cnf  $\wedge$  p3$cnf  $\wedge$  p4$cnf  $\wedge$  p5$cnf  $\wedge$  p6$cnf  $\wedge$  p7$cnf

Out[98]= (Breeze[s] || ! Breezy[s]) && (! Breeze[s] || Breezy[s]) &&
(! Breezy[s] || Pit[East[s]] || Pit[North[s]] || Pit[South[s]] || Pit[West[s]]) &&
(Breezy[s] || ! Pit[East[s]]) && (Breezy[s] || ! Pit[North[s]]) &&
(Breezy[s] || ! Pit[South[s]]) && (Breezy[s] || ! Pit[West[s]]) &&
(! Breezy[s] || ! Pit[East[s]] || ! Pit[North[s]] || ! Pit[South[s]] || Pit[West[s]]) &&
(! Breezy[s] || Pit[East[s]] || ! Pit[North[s]] || ! Pit[South[s]] || ! Pit[West[s]]) &&
(! Breezy[s] || ! Pit[East[s]] || ! Pit[North[s]] || Pit[South[s]] || ! Pit[West[s]]) &&
(! Breezy[s] || ! Pit[East[s]] || Pit[North[s]] || ! Pit[South[s]] || ! Pit[West[s]])
```

Write results to file

```

In[99]:= filename = FileNameJoin[{NotebookDirectory[], "pit_rules.txt"}]
Out[99]= /home/byrdie/School/Classes/CSCI446_Artificial_Intelligence/CSCI446_Artificial
_Intelligence_Project2_Wumpus/src/CSCI446_Project2_Wumpus/Rules/pit_rules.txt

In[100]:= fp = OpenWrite[filename]
Out[100]= OutputStream[  Name: pit_rules.txt
Unique ID: 3 ]

In[101]:= wr[s_] := WriteString[filename, s]

In[102]:= For[i = 1, i <= Length[kb], i++,
  For[j = 1, j <= Length[kb[[i]]], j++,
    wr[ToString[kb[[i, j]]]]
    wr[","]
  ]
  wr["\n"]
]

In[103]:= Close[fp]
Out[103]= /home/byrdie/School/Classes/CSCI446_Artificial_Intelligence/CSCI446_Artificial
_Intelligence_Project2_Wumpus/src/CSCI446_Project2_Wumpus/Rules/pit_rules.txt

```