Tugas Praktikum

Nama : Alif As'ad Ramadhan

NRP : 5054231007

Inferensi : tt-entails

impor terlebih dahulu semua yang ada dalam modul logika

```
%pip install ipythonblocks
%pip install qpsolvers
from utils import*
from logic import *
from notebook import psource
```

```
Requirement already satisfied: ipythonblocks in c:\users\lenovo\
anaconda3\lib\site-packages (1.9.1)
Requirement already satisfied: ipython>=4.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipythonblocks) (8.25.0)
Requirement already satisfied: notebook>=4.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipythonblocks) (7.0.8)
Requirement already satisfied: requests>=1.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipythonblocks) (2.32.2)
Requirement already satisfied: decorator in c:\users\lenovo\anaconda3\
lib\site-packages (from ipython>=4.0->ipythonblocks) (5.1.1)
Requirement already satisfied: jedi>=0.16 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipython>=4.0->ipythonblocks)
(0.18.1)
Requirement already satisfied: matplotlib-inline in c:\users\lenovo\
anaconda3\lib\site-packages (from ipython>=4.0->ipythonblocks) (0.1.6)
Requirement already satisfied: prompt-toolkit<3.1.0,>=3.0.41 in c:\
users\lenovo\anaconda3\lib\site-packages (from ipython>=4.0-
>ipythonblocks) (3.0.43)
Requirement already satisfied: pygments>=2.4.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipython>=4.0->ipythonblocks)
(2.15.1)
Requirement already satisfied: stack-data in c:\users\lenovo\
anaconda3\lib\site-packages (from ipython>=4.0->ipythonblocks) (0.2.0)
Requirement already satisfied: traitlets>=5.13.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipython>=4.0->ipythonblocks)
(5.14.3)
Requirement already satisfied: colorama in c:\users\lenovo\anaconda3\
lib\site-packages (from ipython>=4.0->ipythonblocks) (0.4.6)
Requirement already satisfied: jupyter-server<3,>=2.4.0 in c:\users\
lenovo\anaconda3\lib\site-packages (from notebook>=4.0->ipythonblocks)
(2.14.1)
Requirement already satisfied: jupyterlab-server<3,>=2.22.1 in c:\
users\lenovo\anaconda3\lib\site-packages (from notebook>=4.0-
```

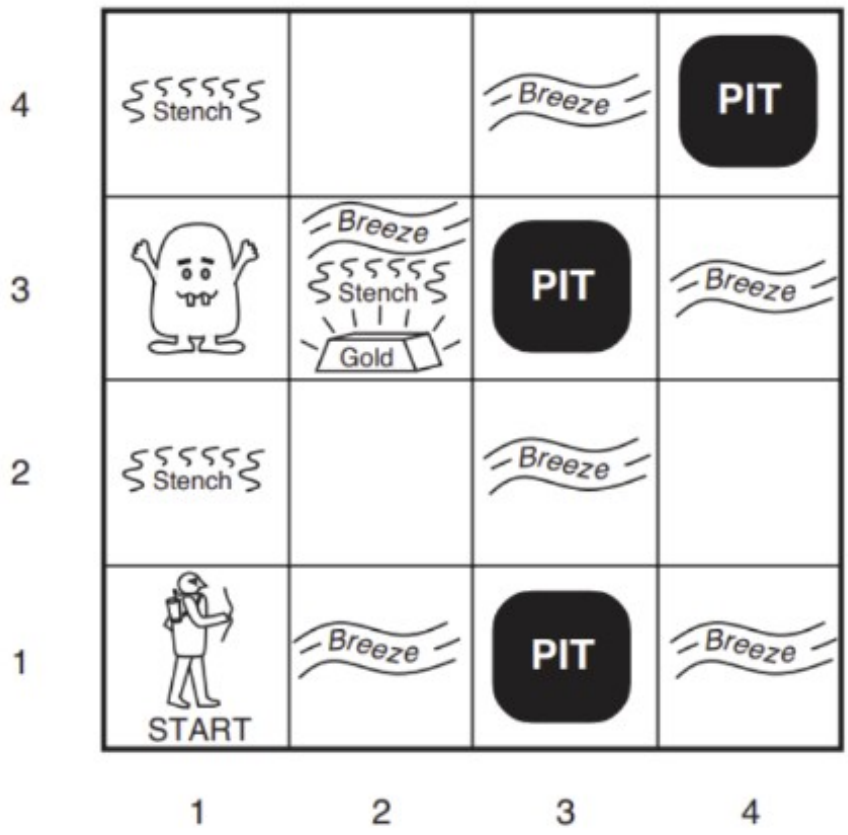
```
>ipythonblocks) (2.25.1)
Requirement already satisfied: jupyterlab<4.1,>=4.0.2 in c:\users\
lenovo\anaconda3\lib\site-packages (from notebook>=4.0->ipythonblocks)
(4.0.11)
Requirement already satisfied: notebook-shim<0.3,>=0.2 in c:\users\
lenovo\anaconda3\lib\site-packages (from notebook>=4.0->ipythonblocks)
(0.2.3)
Requirement already satisfied: tornado>=6.2.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from notebook>=4.0->ipythonblocks)
(6.4.1)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\
lenovo\anaconda3\lib\site-packages (from requests>=1.0->ipythonblocks)
(2.0.4)
Requirement already satisfied: idna<4,>=2.5 in c:\users\lenovo\
anaconda3\lib\site-packages (from requests>=1.0->ipythonblocks) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from requests>=1.0->ipythonblocks)
(2.0.3)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\lenovo\
anaconda3\lib\site-packages (from requests>=1.0->ipythonblocks)
(2024.7.4)
Requirement already satisfied: parso<0.9.0,>=0.8.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jedi>=0.16->ipython>=4.0-
>ipythonblocks) (0.8.3)
Requirement already satisfied: anyio>=3.1.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (4.2.0)
Requirement already satisfied: argon2-cffi>=21.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (21.3.0)
Requirement already satisfied: jinja2>=3.0.3 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (3.1.4)
Requirement already satisfied: jupyter-client>=7.4.4 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (8.6.0)
Requirement already satisfied: jupyter-core!=5.0.*,>=4.12 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (5.7.2)
Requirement already satisfied: jupyter-events>=0.9.0 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (0.10.0)
Requirement already satisfied: jupyter-server-terminals>=0.4.4 in c:\
users\lenovo\anaconda3\lib\site-packages (from jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.4.4)
Requirement already satisfied: nbconvert>=6.4.4 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (7.10.0)
Requirement already satisfied: nbformat>=5.3.0 in c:\users\lenovo\
```

```
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (5.9.2)
Requirement already satisfied: overrides>=5.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (7.4.0)
Requirement already satisfied: packaging>=22.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (23.2)
Requirement already satisfied: prometheus-client>=0.9 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (0.14.1)
Requirement already satisfied: pywinpty>=2.0.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (2.0.10)
Requirement already satisfied: pyzmq>=24 in c:\users\lenovo\anaconda3\
lib\site-packages (from jupyter-server<3,>=2.4.0->notebook>=4.0-
>ipythonblocks) (25.1.2)
Requirement already satisfied: send2trash>=1.8.2 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (1.8.2)
Requirement already satisfied: terminado>=0.8.3 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (0.17.1)
Requirement already satisfied: websocket-client>=1.7 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (1.8.0)
Requirement already satisfied: async-lru>=1.0.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (2.0.4)
Requirement already satisfied: ipykernel in c:\users\lenovo\anaconda3\
lib\site-packages (from jupyterlab<4.1,>=4.0.2->notebook>=4.0-
>ipythonblocks) (6.28.0)
Requirement already satisfied: jupyter-lsp>=2.0.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (2.2.0)
Requirement already satisfied: babel>=2.10 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyterlab-server<3,>=2.22.1-
>notebook>=4.0->ipythonblocks) (2.11.0)
Requirement already satisfied: json5>=0.9.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyterlab-server<3,>=2.22.1-
>notebook>=4.0->ipythonblocks) (0.9.6)
Requirement already satisfied: jsonschema>=4.18.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyterlab-server<3,>=2.22.1-
>notebook>=4.0->ipythonblocks) (4.19.2)
Requirement already satisfied: wcwidth in c:\users\lenovo\anaconda3\
lib\site-packages (from prompt-toolkit<3.1.0,>=3.0.41->ipython>=4.0-
>ipythonblocks) (0.2.5)
Requirement already satisfied: executing in c:\users\lenovo\anaconda3\
lib\site-packages (from stack-data->ipython>=4.0->ipythonblocks)
```

```
(0.8.3)
Requirement already satisfied: asttokens in c:\users\lenovo\anaconda3\
lib\site-packages (from stack-data->ipython>=4.0->ipythonblocks)
(2.0.5)
Requirement already satisfied: pure-eval in c:\users\lenovo\anaconda3\
lib\site-packages (from stack-data->ipython>=4.0->ipythonblocks)
(0.2.2)
Requirement already satisfied: sniffio>=1.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from anyio>=3.1.0->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (1.3.0)
Requirement already satisfied: argon2-cffi-bindings in c:\users\
lenovo\anaconda3\lib\site-packages (from argon2-cffi>=21.1->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (21.2.0)
Requirement already satisfied: pytz>=2015.7 in c:\users\lenovo\
anaconda3\lib\site-packages (from babel>=2.10->jupyterlab-
server<3,>=2.22.1->notebook>=4.0->ipythonblocks) (2024.1)
Requirement already satisfied: MarkupSafe>=2.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jinja2>=3.0.3->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.1.3)
Requirement already satisfied: attrs>=22.2.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema>=4.18.0->jupyterlab-
server<3,>=2.22.1->notebook>=4.0->ipythonblocks) (23.1.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
c:\users\lenovo\anaconda3\lib\site-packages (from jsonschema>=4.18.0-
>jupyterlab-server<3,>=2.22.1->notebook>=4.0->ipythonblocks)
(2023.7.1)
Requirement already satisfied: referencing>=0.28.4 in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema>=4.18.0->jupyterlab-
server<3,>=2.22.1->notebook>=4.0->ipythonblocks) (0.30.2)
Requirement already satisfied: rpds-py>=0.7.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema>=4.18.0->jupyterlab-
server<3,>=2.22.1->notebook>=4.0->ipythonblocks) (0.10.6)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-client>=7.4.4-
>jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.9.0.post0)
Requirement already satisfied: platformdirs>=2.5 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-core!=5.0.*,>=4.12->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (3.10.0)
Requirement already satisfied: pywin32>=300 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-core!=5.0.*,>=4.12->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (305.1)
Requirement already satisfied: python-json-logger>=2.0.4 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-events>=0.9.0-
>jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.0.7)
Requirement already satisfied: pyyaml>=5.3 in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-events>=0.9.0->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (6.0.1)
Requirement already satisfied: rfc3339-validator in c:\users\lenovo\
anaconda3\lib\site-packages (from jupyter-events>=0.9.0->jupyter-
```

```
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.1.4)
Requirement already satisfied: rfc3986-validator>=0.1.1 in c:\users\
lenovo\anaconda3\lib\site-packages (from jupyter-events>=0.9.0-
>jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.1.1)
Requirement already satisfied: beautifulsoup4 in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (4.12.3)
Requirement already satisfied: bleach!=5.0.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (4.1.0)
Requirement already satisfied: defusedxml in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.7.1)
Requirement already satisfied: jupyterlab-pygments in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.1.2)
Requirement already satisfied: mistune<4,>=2.0.3 in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.0.4)
Requirement already satisfied: nbclient>=0.5.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.8.0)
Requirement already satisfied: pandocfilters>=1.4.1 in c:\users\
lenovo\anaconda3\lib\site-packages (from nbconvert>=6.4.4->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (1.5.0)
Requirement already satisfied: tinycss2 in c:\users\lenovo\anaconda3\
lib\site-packages (from nbconvert>=6.4.4->jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (1.2.1)
Requirement already satisfied: fastjsonschema in c:\users\lenovo\
anaconda3\lib\site-packages (from nbformat>=5.3.0->jupyter-
server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.16.2)
Requirement already satisfied: six in c:\users\lenovo\anaconda3\lib\
site-packages (from asttokens->stack-data->ipython>=4.0-
>ipythonblocks) (1.16.0)
Requirement already satisfied: comm>=0.1.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipykernel->jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (0.2.1)
Requirement already satisfied: debugpy>=1.6.5 in c:\users\lenovo\
anaconda3\lib\site-packages (from ipykernel->jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (1.6.7)
Requirement already satisfied: nest-asyncio in c:\users\lenovo\
anaconda3\lib\site-packages (from ipykernel->jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (1.6.0)
Requirement already satisfied: psutil in c:\users\lenovo\anaconda3\
lib\site-packages (from ipykernel->jupyterlab<4.1,>=4.0.2-
>notebook>=4.0->ipythonblocks) (5.9.0)
Requirement already satisfied: webencodings in c:\users\lenovo\
anaconda3\lib\site-packages (from bleach!=5.0.0->nbconvert>=6.4.4-
>jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (0.5.1)
```

```
Requirement already satisfied: fqdn in c:\users\lenovo\anaconda3\lib\
site-packages (from jsonschema[format-nongpl]>=4.18.0->jupyter-
events>=0.9.0->jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks)
(1.5.1)
Requirement already satisfied: isoduration in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema[format-nongpl]>=4.18.0-
>jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->notebook>=4.0-
>ipythonblocks) (20.11.0)
Requirement already satisfied: jsonpointer>1.13 in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema[format-nongpl]>=4.18.0-
>jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->notebook>=4.0-
>ipythonblocks) (2.1)
Requirement already satisfied: uri-template in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema[format-nongpl]>=4.18.0-
>jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->notebook>=4.0-
>ipythonblocks) (1.3.0)
Requirement already satisfied: webcolors>=1.11 in c:\users\lenovo\
anaconda3\lib\site-packages (from jsonschema[format-nongpl]>=4.18.0-
>jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0->notebook>=4.0-
>ipythonblocks) (24.8.0)
Requirement already satisfied: cffi>=1.0.1 in c:\users\lenovo\
anaconda3\lib\site-packages (from argon2-cffi-bindings->argon2-
cffi>=21.1->jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks)
(1.16.0)
Requirement already satisfied: soupsieve>1.2 in c:\users\lenovo\
anaconda3\lib\site-packages (from beautifulsoup4->nbconvert>=6.4.4-
>jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks) (2.5)
Requirement already satisfied: pycparser in c:\users\lenovo\anaconda3\
lib\site-packages (from cffi>=1.0.1->argon2-cffi-bindings->argon2-
cffi>=21.1->jupyter-server<3,>=2.4.0->notebook>=4.0->ipythonblocks)
(2.21)
Requirement already satisfied: arrow>=0.15.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from isoduration->jsonschema[format-
nongpl]>=4.18.0->jupyter-events>=0.9.0->jupyter-server<3,>=2.4.0-
>notebook>=4.0->ipythonblocks) (1.2.3)
Note: you may need to restart the kernel to use updated packages.
Requirement already satisfied: qpsolvers in c:\users\lenovo\anaconda3\
lib\site-packages (4.3.3)
Requirement already satisfied: numpy>=1.15.4 in c:\users\lenovo\
anaconda3\lib\site-packages (from qpsolvers) (1.26.4)
Requirement already satisfied: scipy>=1.2.0 in c:\users\lenovo\
anaconda3\lib\site-packages (from qpsolvers) (1.13.1)
Note: you may need to restart the kernel to use updated packages.
```

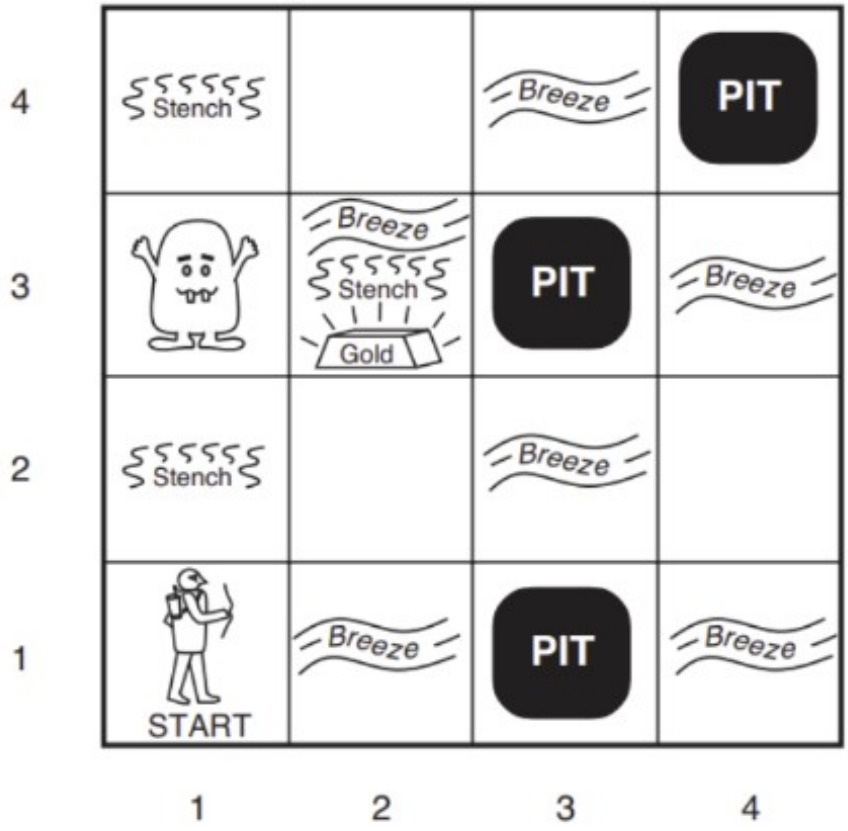


Definisikan variabel untuk tiap lokasi, Pit (P), Breeze (B), Stench (S), dan Wumpus (W)

1. Membuat ProbKB

```
P11, P12, P13, P14 = expr('P11, P12, P13, P14')
P21, P22, P23, P24 = expr('P21, P22, P23, P24')
P31, P32, P33, P34 = expr('P31, P32, P33, P34')
P41, P42, P43, P44 = expr('P41, P42, P43, P44')

B11, B12, B13, B14 = expr('B11, B12, B13, B14')
B21, B22, B23, B24 = expr('B21, B22, B23, B24')
B31, B32, B33, B34 = expr('B31, B32, B33, B34')
B41, B42, B43, B44 = expr('B41, B42, B43, B44')

S11, S12, S13, S14 = expr('S11, S12, S13, S14')
S21, S22, S23, S24 = expr('S21, S22, S23, S24')
S31, S32, S33, S34 = expr('S31, S32, S33, S34')
S41, S42, S43, S44 = expr('S41, S42, S43, S44')

W11, W12, W13, W14 = expr('W11, W12, W13, W14')
W21, W22, W23, W24 = expr('W21, W22, W23, W24')
W31, W32, W33, W34 = expr('W31, W32, W33, W34')
W41, W42, W43, W44 = expr('W41, W42, W43, W44')
```

```
Gold23 = expr('Gold23')

# Inisialisasi knowledge base untuk Wumpus
wumpus_kb = PropKB()
```




```
# Informasi awal:
wumpus_kb.tell(~P11)  # Tidak ada Pit di [1,1]
wumpus_kb.tell(~W11)  # Tidak ada Wumpus di [1,1]

# B21 berarti ada Pit di sekitar [1,1], [2,2], atau [3,1]
wumpus_kb.tell(B21 | '<=>' | ((P11 | P22 | P31)))

# B12 berarti ada Pit di sekitar [1,1], [1,3], atau [2,2]
wumpus_kb.tell(B12 | '<=>' | ((P11 | P13 | P22)))

# B23 berarti ada Pit di sekitar [2,2], [2,4], [1,3], [3,3]
wumpus_kb.tell(B23 | '<=>' | ((P22 | P13 | P24 | P23)))

# B32 berarti ada Pit di sekitar [3,3], [2,2], [4,2], [3,1]
wumpus_kb.tell(B23 | '<=>' | ((P33 | P22 | P42 | P31)))

# S32 berarti ada Wumpus di sekitar [3,3], [2,2], [4,2], [3,1]
```

```
wumpus_kb.tell(S23 | '<=>' | ((W33 | W22 | W42 | W31)))

# S23 berarti ada Wumpus di sekitar [2,3]
wumpus_kb.tell(S21 | '<=>' | (W31 | W11 | W22))


# Kondisi pasti
wumpus_kb.tell(P13)     # Ada Pit di [1,3]
wumpus_kb.tell(W31)     # Ada Wumpus di [3,1]
wumpus_kb.tell(~P22)    # Tidak ada Pit di [2,2]
wumpus_kb.tell(~W22)    # Tidak ada Wumpus di [2,2]
wumpus_kb.tell(P33)     # Ada Pit di [3,3]
wumpus_kb.tell(~P12)    # Tidak ada Pit di [1,2]
wumpus_kb.tell(~W12)    # Tidak ada Wumpus di [1,2]
wumpus_kb.tell(~P23)    # Tidak ada Pit di [2,3]
wumpus_kb.tell(~W23)    # Tidak ada Wumpus di [2,3]

# Gold di [2,3]
wumpus_kb.tell(Gold23)
```

Kita dapat memeriksa klausa yang disimpan dalam KB

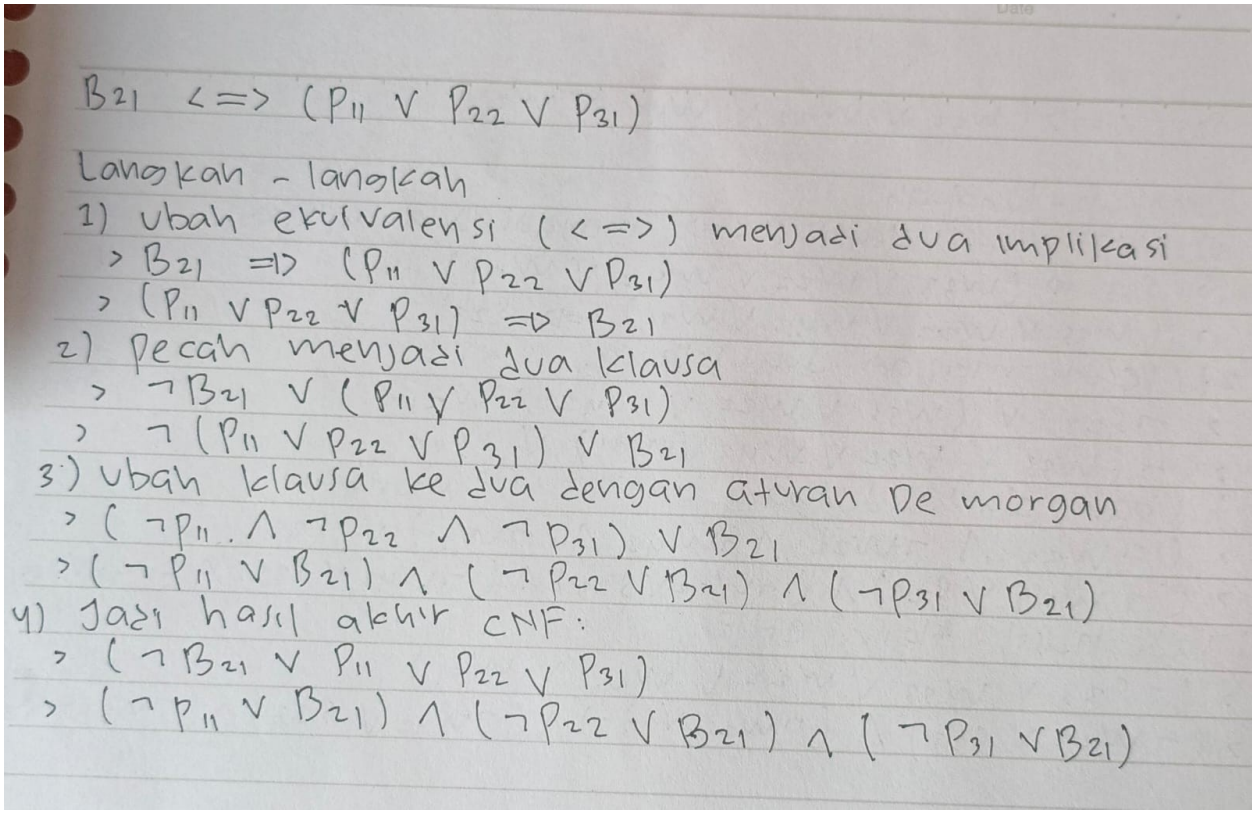
```
wumpus_kb.clauses
```

```
[~P11,
 ~W11,
 (~P11 | B21),
 (~P22 | B21),
 (~P31 | B21),
 (P11 | P22 | P31 | ~B21),
 (~P11 | B12),
 (~P13 | B12),
 (~P22 | B12),
 (P11 | P13 | P22 | ~B12),
 (~P22 | B23),
 (~P13 | B23),
 (~P24 | B23),
 (~P23 | B23),
 (P22 | P13 | P24 | P23 | ~B23),
 (~P33 | B23),
 (~P22 | B23),
 (~P42 | B23),
 (~P31 | B23),
 (P33 | P22 | P42 | P31 | ~B23),
 (~W33 | S23),
 (~W22 | S23),
 (~W42 | S23),
 (~W31 | S23),
 (W33 | W22 | W42 | W31 | ~S23),
 (~W31 | S21),
```

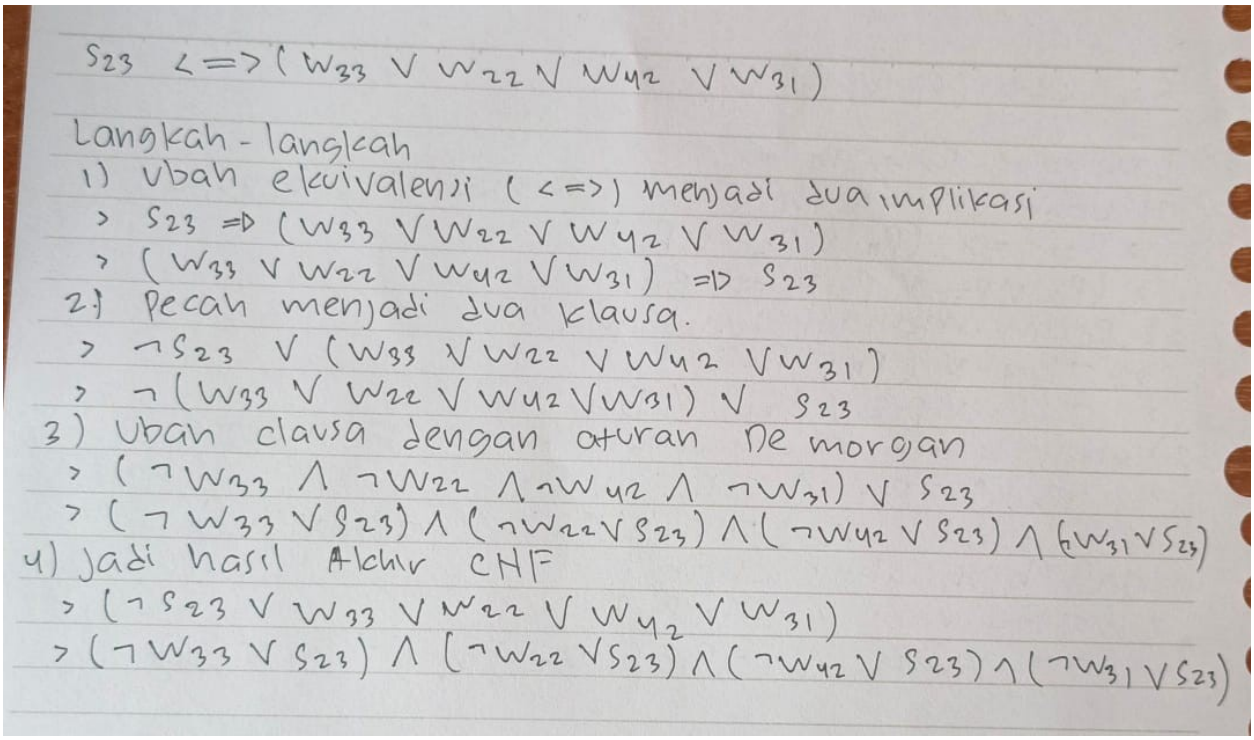
```
 (~W11 | S21),
 (~W22 | S21),
 (W31 | W11 | W22 | ~S21),
 P13,
 W31,
 ~P22,
 ~W22,
 P33,
 ~P12,
 ~W12,
 ~P23,
 ~W23,
 Gold23]
```

Proses pengubahan klausa menjadi `Conjunctive Normal Form (CNF)`

Contoh 1:



Contoh 2:



Proses pengubahan Klausa akan sama seperti contoh 1 dan 2, dengan 3 tahapan:

1. Ubah ekuivalensi (<==>) menjadi dua Implikasi
2. Pecah menjadi dua klausa
3. Ubah klausa dengan aturan De Morgan

Fungsi - fungsi yang digunakan

```
psource(tt_check_all)
```

```
<IPython.core.display.HTML object>
```

```
psource(tt_entails)
```

```
<IPython.core.display.HTML object>
```

Membuat Fungsi untuk melakukan cek apakah jalur [1,1] ke [2,3] aman

```
def is_safe_path(kb):
    safe = True
```

```
    # Periksa apakah [1,2] aman (tidak ada pit dan wumpus)
    safe = safe and wumpus_kb.ask_if_true(~P12) and
wumpus_kb.ask_if_true(~W12)

    # Periksa apakah [2,2] aman (tidak ada pit dan wumpus)
    safe = safe and wumpus_kb.ask_if_true(~P22) and
wumpus_kb.ask_if_true(~W22)

    # Periksa apakah [2,3] aman (tidak ada pit dan wumpus, dan ada
emas)
    safe = safe and wumpus_kb.ask_if_true(~P23) and
wumpus_kb.ask_if_true(~W23) and wumpus_kb.ask_if_true(Gold23)

    return safe

# Jalankan pengecekan apakah jalur aman
if is_safe_path(wumpus_kb):
    print("Jalur dari [1,1] ke [2,3] aman.")
else:
    print("Jalur dari [1,1] ke [2,3] tidak aman.")
```

```
Jalur dari [1,1] ke [2,3] aman.
```

```
# Cek apakah ada emas di kolom [2,3]
wumpus_kb.ask_if_true(Gold23)
```

```
True
```

Pembuktian Menggunakan Truth Table

Dalam pembuktian menggunakan tabel kebenaran (truth table), Fokus utama adalah mengincar kombinasi nilai yang menghasilkan nilai true (benar) karena tujuan utama dari pembuktian adalah untuk menunjukkan bahwa proposisi yang kita analisis adalah valid atau konsisten. Untuk melakukannya berikut tahapan yang akan di lakukan untuk mendapatkan kombinasi nilai yang bernilai true (benar)

```
import itertools
import pandas as pd
# menyimpan semua kalusa yang di simpan dalam KB
clauses = ['P11', 'W11', 'P22', 'P31', 'P13', 'B21', 'B12', 'B23',
'P33', 'P24', 'P42', 'W33', 'W22', 'W42', 'W31', 'S23', 'S21',
'Gold23', 'P23', 'P12', 'W12', 'W23']

# Buat semua kemungkinan kombinasi True/False untuk setiap variabel
combinations = list(itertools.product([True, False],
repeat=len(clauses)))
```

```
# Fungsi untuk mengevaluasi setiap klausa
def evaluate_clause(assignment):
    P11, W11, P22, P31, P13, B21, B12, B23, P33, P24, P42, W33, W22,
W42, W31, S23, S21, Gold23, P23, P12, W12, W23 = assignment
    return (
        not P11 and
        not W11 and
        (not P11 or B21) and
        (not P22 or B21) and
        (not P31 or B21) and
        (P11 or P22 or P31 or not B21) and
        (not P11 or B12) and
        (not P13 or B12) and
        (not P22 or B12) and
        (P11 or P13 or P22 or not B12) and
        (not P22 or B23) and
        (not P13 or B23) and
        (not P24 or B23) and
        (not P23 or B23) and
        (P22 or P13 or P24 or P23 or not B23) and
        (not P33 or B23) and
        (not P22 or B23) and
        (not P42 or B23) and
        (not P31 or B23) and
        (P33 or P22 or P42 or P31 or not B23) and
        (not W33 or S23) and
        (not W22 or S23) and
        (not W42 or S23) and
        (not W31 or S23) and
        (W33 or W22 or W42 or W31 or not S23) and
        (not W31 or S21) and
        (not W11 or S21) and
        (not W22 or S21) and
        (W31 or W11 or W22 or not S21) and
        P13 and
        W31 and
        not P22 and
        not W22 and
        P33 and
        not P12 and
        not W12 and
        not P23 and
        not W23 and
        Gold23
    )

# Evaluasi setiap kombinasi berdasarkan klausa
results = [evaluate_clause(assignment) for assignment in combinations]
```

```
# Buat DataFrame dari kombinasi variabel dan hasil evaluasi
df = pd.DataFrame(combinations, columns=clauses)
df['KB'] = results

# Tampilan DataFrame
df.head(10)
```

```
    P11   W11   P22   P31   P13   B21   B12   B23   P33   P24  ...
W42  \
0  True  True  True  True  True  True  True  True  True  True  ...
True
1  True  True  True  True  True  True  True  True  True  True  ...
True
2  True  True  True  True  True  True  True  True  True  True  ...
True
3  True  True  True  True  True  True  True  True  True  True  ...
True
4  True  True  True  True  True  True  True  True  True  True  ...
True
5  True  True  True  True  True  True  True  True  True  True  ...
True
6  True  True  True  True  True  True  True  True  True  True  ...
True
7  True  True  True  True  True  True  True  True  True  True  ...
True
8  True  True  True  True  True  True  True  True  True  True  ...
True
9  True  True  True  True  True  True  True  True  True  True  ...
True

    W31   S23   S21  Gold23    P23    P12    W12    W23     KB
0  True  True  True    True   True   True   True   True  False
1  True  True  True    True   True   True   True  False  False
2  True  True  True    True   True   True  False   True  False
3  True  True  True    True   True   True  False  False  False
4  True  True  True    True   True  False   True   True  False
5  True  True  True    True   True  False   True  False  False
6  True  True  True    True   True  False  False   True  False
7  True  True  True    True   True  False  False  False  False
8  True  True  True    True  False   True   True   True  False
9  True  True  True    True  False   True   True  False  False

[10 rows x 23 columns]
```

Cek berapa kombinasi (KB) yang bernilai True

```
kb = pd.DataFrame(df.KB.value_counts().reset_index())
kb.head()
```

```
      KB    count
0  False  4194272
1   True       32
```

Dari banyak kombinasi yang di coba, diketahui KB yang bernilai `True` sebanyak `32`

```
# Menampilkan Truth Table dari kombinasi yang memiliki KB yang
bernilai `True`
kb_true = df[df['KB'] == True]
kb_true.head(10)
```

```
           P11    W11    P22   P31   P13   B21   B12   B23   P33
P24  ...  \
3670543  False  False  False  True  True  True  True  True  True
True  ...
3670799  False  False  False  True  True  True  True  True  True
True  ...
3671567  False  False  False  True  True  True  True  True  True
True  ...
3671823  False  False  False  True  True  True  True  True  True
True  ...
3672591  False  False  False  True  True  True  True  True  True
True  ...
3672847  False  False  False  True  True  True  True  True  True
True  ...
3673615  False  False  False  True  True  True  True  True  True
True  ...
3673871  False  False  False  True  True  True  True  True  True
True  ...
3674639  False  False  False  True  True  True  True  True  True
False  ...
3674895  False  False  False  True  True  True  True  True  True
False  ...

           W42   W31   S23   S21  Gold23    P23    P12    W12    W23
KB
3670543   True  True  True  True    True  False  False  False  False
True
3670799  False  True  True  True    True  False  False  False  False
True
3671567   True  True  True  True    True  False  False  False  False
True
3671823  False  True  True  True    True  False  False  False  False
True
3672591   True  True  True  True    True  False  False  False  False
True
3672847  False  True  True  True    True  False  False  False  False
True
```

```
3673615   True  True  True  True    True  False  False  False  False
True
3673871  False  True  True  True    True  False  False  False  False
True
3674639   True  True  True  True    True  False  False  False  False
True
3674895  False  True  True  True    True  False  False  False  False
True

[10 rows x 23 columns]
```

Cek apakah pada kotak `[2,3]` aman dilewati

Koordinat `[2,3]` didefinisikan aman jika pada koordinat tersebut tidak terdapat `Wumpus` dan tidak terdapat `Pit`

```
kb_true_safe = pd.DataFrame(kb_true[['W23',
'P23']].value_counts().reset_index(name='count'))
kb_true_safe
```

```
     W23    P23  count
0  False  False     32
```

Cek apakah pada kotak [2,3] terdapat emas

```
kb_true_gold =
pd.DataFrame(kb_true['Gold23'].value_counts().reset_index(name='count'
))
kb_true_gold
```

```
   Gold23  count
0    True     32
```

Jadi setiap kombinasi tabel kebenaran yang memiliki KB True, maka menandakan bahwa koordinat [2,3] aman untuk dilewati dan terdapat emas