Name:-Ritesh Badhe roll no:-115 batch:-H date:-25/1/25

Practical no:-9&8 Study of Operation Research in Python(LPP)

Q1)Write a Python program to solve the following LPP: Max Z = 150x + 75y subject to 4x + 6y ≤ 24 5x + 3y ≤ 15 x ≥ 0, y ≥ 0

In [2]:
```
from pulp import* lpp=LpProblem(name='LPP',
sense=LpMaximize) x=LpVariable("x",
lowBound=0) y=LpVariable("y", lowBound=0)
lpp +=(4*x + 6 * y <= 24) lpp +=(5*x + 3* y
<= 15) lpp += (150*x + 75 * y) lpp
```

Out[2]:
```
LPP:
MAXIMIZE
150 *x + 75*y +  0
SUBJECT TO
_C1: 4 x + 6 y <= 24

_C2: 5 x + 3 y <= 15

VARIABLES x
Continuous y
Continuous
```

In [4]:
```
lpp.solve()
```

Out[4]:
```
1
```

In [5]:
```
lpp.objective.value()
```

Out[5]:
```
450.0
```

In [6]:
```
x.value()
```

Out[6]:
```
3.0
```

In [7]:
```
y.value()
```

Out[7]:
```
0.0
```

Q2)Write a Python program to solve the following LPP: Max Z = 5x + 3y subject to x + y ≤ 7 2x + 5y ≤ 1 x ≥ 0, y ≥ 0.

In [8]:
```
from pulp import* lpp=LpProblem(name='LPP',
sense=LpMaximize) x=LpVariable("x",
lowBound=0) y=LpVariable("y", lowBound=0)
lpp +=(x +  y <= 7) lpp +=(2*x + 5* y <= 1)
lpp += (5*x + 3* y) lpp
```

Out[8]:
```
LPP:
MAXIMIZE
5 *x + 3*y +  0
SUBJECT TO
_C1: x + y <= 7 _C2:

2 x + 5 y <= 1


VARIABLES x
Continuous y
Continuous
```

In [9]:
```
lpp.solve()
```

Out[9]:
```
1
```

In [10]:
```
lpp.objective.value()
```

Out[10]:
```
2.5
```

In [11]:
```
x.value()
```

Out[11]:
```
0.5
```

In [12]:
```
y.value()
```

Out[12]:
```
0.0
```

Q3)Write a Python program to solve the following LPP: Max Z = x + y subject to 2x − 2y ≥ 1 x + y ≥ 2 x ≥ 0, y ≥ 0.

In [16]:
```
from pulp import* lpp=LpProblem(name='LPP',
sense=LpMaximize) x=LpVariable("x",
lowBound=0) y=LpVariable("y", lowBound=0)
lpp +=(2*x - 2* y >= 1) lpp +=(x +  y >= 2)
lpp += (x +  y) lpp
```

Out[16]:
```
LPP:
MAXIMIZE
1 *x + 1*y +  0
SUBJECT TO
_C1: 2 x - 2 y >= 1

_C2: x + y >= 2

VARIABLES x
Continuous y
Continuous
lpp.solve()
```

In [18]:
```
-2
```

Out[18]:
```
lpp.objective.value()
```

In [19]:
```
0.0
```

Out[19]:

In [20]:
```
x.value()
```

Out[20]:
```
0.0
```

In [21]:
```
y.value()
```

Out[21]:
```
0.0
```

Q4)Write a Python program to solve the following LPP: Min Z = 3.5x + 2y subject to x + y ≥ 5 x ≥ 4 y ≤ 2 x ≥ 0, y ≥ 0.

In [45]:
```
from pulp import*
lpp=LpProblem(name='LPP',sense=LpMinimize)
x=LpVariable("x",lowBound=0)
y=LpVariable("y",lowBound=0) lpp +=(x + y
>= 5) lpp +=(x >= 4) lpp +=(y <= 2) lpp
+=(3.5 * x + 2 * y ) lpp

LPP:
MINIMIZE
3.5 *x + 2*y  + 0.0
```

Out[45]:
```
SUBJECT TO
_C1: x + y >= 5

_C2: x >= 4

_C3: y <= 2

VARIABLES x
Continuous y
Continuous
lpp.solve()
```

In [46]:
```
1
```

Out[46]:
```
lpp.objective.value()
```

In [47]:
```
16.0
```

Out[47]:
```
x.value()
```

In [48]:
```
4.0
```

Out[48]:
```
y.value()
```

In [49]:
```
1.0
```

Out[49]:

Q5)Solve LPP

```
from pulp import*
lpp=LpProblem(name='LPP',sense=LpMinimize)
x=LpVariable("x",lowBound=0)
y=LpVariable("y",lowBound=0) lpp +=( x >=
6) lpp +=( y >= 6) lpp +=( x + y >= 11)
```

by using python: Min Z = x + y subject to x ≥ 6 y ≥ 6 x + y ≥ 11 x ≥ 0, y ≥ 0.

In [36]:
```
lpp +=( x +  y )
lpp
```

Out[36]:
```
LPP:
MINIMIZE
1 *x + 1*y +  0
SUBJECT TO
_C1: x >= 6

_C2: y >= 6

_C3: x + y >= 11

VARIABLES x
Continuous y
Continuous
```

In [37]:
```
lpp.solve()
```

Out[37]:
```
1
```

In [38]:
```
lpp.objective.value()
```

Out[38]:
```
12.0
```

In [39]:
```
x.value()
```

Out[39]:
```
6.0
```

In [40]:
```
y.value()
```

Out[40]:
```
6.0
```

Q6)Write a Python program to solve the following LPP: Max Z = 4x + y + 3z + 5w subject to 4x + 6y−5z−4w ≥−20 −8x−3y + 3 z + 2w ≤ 20 x ≥ 0,y ≥ 0

In [29]:
```
from pulp import* lpp=LpProblem(name='LPP',
sense=LpMaximize) x=LpVariable("x",
lowBound=0) y=LpVariable("y", lowBound=0)
z=LpVariable("z", lowBound=0)
w=LpVariable("w", lowBound=0) lpp +=(4*x +
6*y - 5*z - 5*w >= -20) lpp +=(-8*x - -3*y
+3*z + 2*w <= 20) lpp +=(4*x +  y + 3*z
+5*w) lpp
```

Out[29]:
```
LPP:
MAXIMIZE 5 *w + 4*x + 1*y
+ 3*z +  0
SUBJECT TO
_C1: - 5 w + 4 x + 6 y - 5 z >= -20 _C2:

2 w - 8 x + 3 y + 3 z <= 20


VARIABLES w
Continuous x
Continuous y
```

```
Continuous z
Continuous
```

In [30]:
```
lpp.solve()
```

Out[30]:
```
-2
```

In [31]:
```
lpp.objective.value()
```

Out[31]:
```
20.0
```

In [32]:
```
x.value()
```

Out[32]:
```
0.0
```

In [33]:
```
y.value()
```

Out[33]:
```
0.0
```

In [34]:
```
z.value()
```

Out[34]:
```
0.0
```

In [35]:
```
w.value()
```

Out[35]:
```
4.0
```