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11 & 12 Practical name '-Study Of Operation Research in Python(LPP)

Q1) Write a python program to display the following LPP by using  
pulp module and simplex method. Find its optimal solution if  
exist Max  $Z = x + 2y + z$  subject to  $x + 2y \leq 1$ ,  $3x + 2y + z \geq 8$ ,  $x \geq 0$   
2 0,2 2 0

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

```
Out[1]: LPP:
MAXIMIZE
1*x + 2*y + 1*z + 0
SUBJECT TO
_C1: x + 2 y + 2 z <= 1
_C2: 3 x + 2 y + z >= 8

VARIABLE
S x
Continuo
us y
Continuo
us z
Continuo
us
```

```
[2]: lpp.solve()
out[2] -1
:
```

```
[3]: lpp.
objective.
value()
```

```
out[3] 2.666667
:
```

```
[4]: x. value()
```

```
Out[4] 2.666667
:
```

```
[5]: y. value()
0.0
```

```
out(S)
:
```

Q2) Write a python program to display the following LPP by using  
pulp module and simplex method.  
Find its optimal solution if exist Max  $Z = 3x + 5y + 4z$  subject  
to  $2x + 3y + 8z \leq 10$ ,  $3x + 2y + 4z \leq 15$ ,  $x \geq 0, y \geq 0, z \geq 0$ .

```
In [6]: from pulp import*
lpp=LpProblem(name='LPP',sense=LpMaximize)
x=LpVariable("x",lowBound=0)
y=LpVariable("y",lowBound=0)
z=LpVariable("z",lowBound=0)
lpp+=(2*x+3*y<=8)
lpp+=(2*y+5*z<=10)
lpp+=(3*x+2*y+4*z<=15)
lpp+=(3*x+5*y+4*z)
lpp

"x" , lowboundza)
, lowboundza)

Z<z15)
out[61 : LPP:
MAXIMIZE
3*x + 5*y + 4*z + 0
SUBJECT TO
_C1: 2 x + 3 y <= 8
_C2: 2 y + 5 z <= 10
_C3: 3 x + 2 y + 4 z <= 15
```

```
VARIABLE
S x
Continuo
us y
Continuo
us z
Continuo
us
```

```
[7]: lpp.solve()
out[11] 1
:
[8]: lpp.objective.value()
out(S) 18.658536500000004
:
[9]: x.value()
out[g] 2.1707317
:
```

```
In [10]: y.value()
```

```
out[10] 1.2195122
```

```
:
Q3) Write a python program to display the following LPP by
using pulp module and simplex method.
Find its optimal solution if exist Max  $Z = 4x + y + 3z + sw$ 
subject to  $4x + 5y - 5z - 4w \geq 20$   $-3x - 2y +$ 
 $+ w \leq 10$   $-8x - 3y + 3z + 2w \leq 20$   $x \geq 0, y \geq 0, z \geq 0, w \geq 0.$ 
```

```
In [11]: 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-4*w>=20)
lpp+=((-3)*x-2*y+4*z+w<=10)
lpp+=((-8)*x-3*y+3*z+2*w<=20)
lpp+=(4*x+y+3*z+5*w)
```

```
out[11] 1
:
LPP:
MAXIMIZE
```

```

5*w + 4*x + 1*y + 3*z + 0
SUBJECT TO
_C1: - 4 w + 4 x + 6 y - 5 z >= 20

_C2: w - 3 x - 2 y + 4 z <= 10

_C3: 2 w - 8 x - 3 y + 3 z <= 20

```

```

VARIABLES
    w Continuous
    x Continuous
    y Continuous
    z Continuous

```

```

In
1121
: Ipp.solve()
outli21 : -2

In 1131 : Ipp. objective. value()
outli31 : 3.3333333

In 1141 : x. value()
outli41 : 0.0

```

```

In I y. value()
IS) : 3.3333333

```

```

outli51 Q4) Write a python program to display the following LPP by
: using pulp module and simplex method.
Find its optimal solution if exist Max Z = 3x + 2y + 5z
subject to x + 2y + z ≤ 430 3x + 4z ≤ 460 x +
4y ≤ 120 x ≥ 0, y ≥ 0, z ≥ 0

```

```

from pulp import*
lpp=LpProblem(name='LPP',sense=LpMaximize)
x=LpVariable("x",lowBound=0)
y=LpVariable("y",lowBound=0)
z=LpVariable("z",lowBound=0)
lpp+=(x+2*y+z<=430)
lpp+=(3*x+4*z<=460)
lpp+=(x+4*y<=120)
lpp+=(3*x+2*y+5*z)
lpp

```

```

In 1161 : outli61 LPP:
3*x + 2*y + 5*z + 0
SUBJECT TO : MAXIMIZE
_C1: x + 2 y + z <= 430e
_C2: 3 x + 4 z <= 4 46B
_C3: x + 4 y <= 120

```

```

11 x ≥ 0, y ≥ 0

```

```

        VARIABLES
        x
        Continuous
        y
        Continuous
        z
        Continuous
[17]:
out1111 Ipp.solve()
:
1
In 1181 : Ipp. objective.
value()
out11g1 635.0
:
In 1191 : x. value()
0.0
out11g1 :
y. value()
In 12e1 : 30.0
out12e1 :
Q5) Write a Python program to solve the following LPP: Min Z = x
+ y subject to X ≤ 6, y ≤ 6, x + y ≤ 11
ln 1211 : from pulp import *
lpp=LpProblem(name='LPP
x=LpVariable("x",low
y=LpVariable("y",low
lpp+=(x>=6)
lpp+=(y>=6)
lpp+=(x+y<=11)
lpp+=(x+y
lpp
,sense=LpMinimize)
"x" , lowbound=0)
"y" , lowbound=0)
out1211 : LPP:
MINIMIZE
1*x + 1*y + 0
SUBJECT TO
_C1: x >= 6
_C2: y >= 6
_C3: x + y <= 11
VARIABLE
S x
Continuous
us y
Continuous
us

```

```
ln 1221 Ipp.solve()  
:  
out1221  
:  
Ipp.  
[23]: objective.  
value()  
out1231 12.0  
:  
[24]: x. value()  
out1241 6.0  
:  
[25]: y. value()  
out12s1 : 6.0
```