单纯性法实验报告

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1)调用 Getdata()函数：根据输入构造线性规划模型

2)调用 Deal()函数,将线性规划标准化：统一转化成 max 问题并添加松弛变量

3)调用 Base()函数：逐列匹配单位矩阵的列与约束条件系数矩阵的列，判断原约束条件矩阵是否存在单位阵

i)不存在单位阵则添加人工变量并将人工变量加入基向量,根据原变量和人工变量得到初始基变量,进行两阶段单纯性法

ii)存在单位阵,则直接根据原变量构造初始基变量,进行一次单纯性法即可

4)得到基向量后,调用 simplex 进行单纯性法

计算检验值,根据检验值选择换入变量

1)如果所有检验值都不大于 0

i)检查检验值,如果检验值中 0 的个数多余约束条件个数,返回 3

ii) 0 的个数等于约束条件个数,返回 1

2)有检验值大于 0,选作换入变量,根据 $\mathbf{b_i}/A_{ij}$ 选择换出变量

i)如果所有 A_{ij} 都不大于 0,返回 2

ii)选择出合适的换入变量

进行基变量的变换，并更新单纯性表

重复上述步骤直到结束

1.一次单纯性法:直接调用 simplex,根据 simplex 返回值判断解情况并输出

2.二次单纯性法:

更改目标函数系数,进行一次单纯性法计算,结束后,判断人工变量是 否全 0，

i)不全 0 则为情况 4,直接结束

ii)全 0,进行二阶段

5)根据 simplex 返回值进行情况判断,进行输出

case1：唯一最优解

case2：无界解

case3：无穷多最优解

case4：无解

测试结果：

1a)

```
[soda@soda lab1]$ ./simplex
0
2 2
6 4
2 1 1 2
3 4 1.5 2

Stage1.  Step1:
------------------------------------------------------------
         C            |   0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   -1  |  x5  |  1  |  2  1  -1  0  1  0
   -1  |  x6  |  1.5  |  3  4  0  -1  0  1
------------------------------------------------------------
      Sigama        |     5  5  -1  -1  0  0

Stage1.  Step2:
------------------------------------------------------------
         C            |   0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x1  |  0.5  |  1  0.5  -0.5  0  0.5  0
   -1  |  x6  |  0  |  0  2.5  1.5  -1  -1.5  1
------------------------------------------------------------
      Sigama        |     0  2.5  1.5  -1  -2.5  0
```

```
Stage1.  Step3:
------------------------------------------------------------
         C            |   0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x1  |  0.5  |  1  0  -0.8  0.2  0.8  -0.2
   0  |  x2  |  0  |  0  1  0.6  -0.4  -0.6  0.4
------------------------------------------------------------
      Sigama        |     0  0  0  0  -1  -1
The number of optimal solution is unlimited
z* is  -0

Stage2.  Step1:
------------------------------------------------------------
         C            |   -6  -4  -0  -0
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4
------------------------------------------------------------
   -6  |  x1  |  0.5  |  1  0  -0.8  0.2
   -4  |  x2  |  0  |  0  1  0.6  -0.4
------------------------------------------------------------
      Sigama        |     0  0  -2.4  -0.4
The optimal solution of the problrm is
x* = [0.5 0 0 0 ]
z* = 3
```

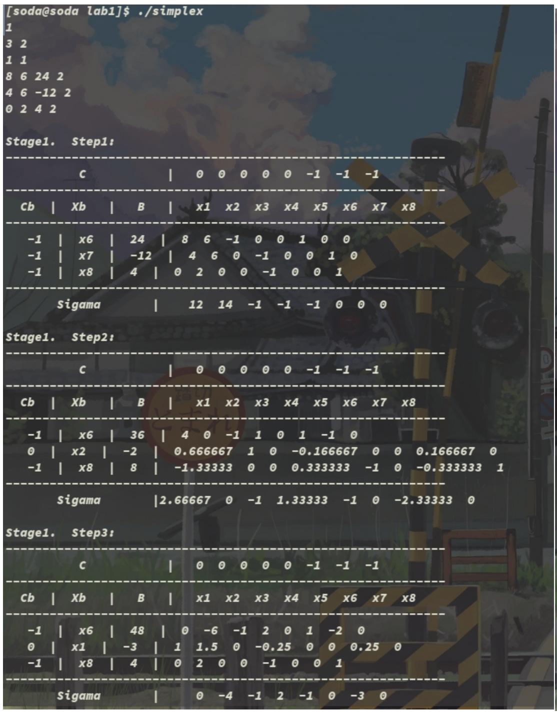
1b)

```
[soda@soda lab1]$ ./simplex
1
2 2
4 8
2 2 10 1
-1 1 8 2

Stage1.  Step1:
------------------------------------------------------------
         C            |   0  0  0  0  -1
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4  x5
------------------------------------------------------------
   0  |  x3  |  10  |  2  2  1  0  0
   -1  |  x5  |  8  |  -1  1  0  -1  1
------------------------------------------------------------
      Sigama        |    -1  1  0  -1  0

Stage1.  Step2:
------------------------------------------------------------
         C            |   0  0  0  0  -1
------------------------------------------------------------
  Cb  |  Xb    |   B   |   x1  x2  x3  x4  x5
------------------------------------------------------------
   0  |  x2  |  5  |  1  1  0.5  0  0
   -1  |  x5  |  3  |  -2  0  -0.5  -1  1
------------------------------------------------------------
      Sigama        |    -2  0  -0.5  -1  0
The problem doesn't has a feasible solution.
[soda@soda lab1]$ |
```

1c)

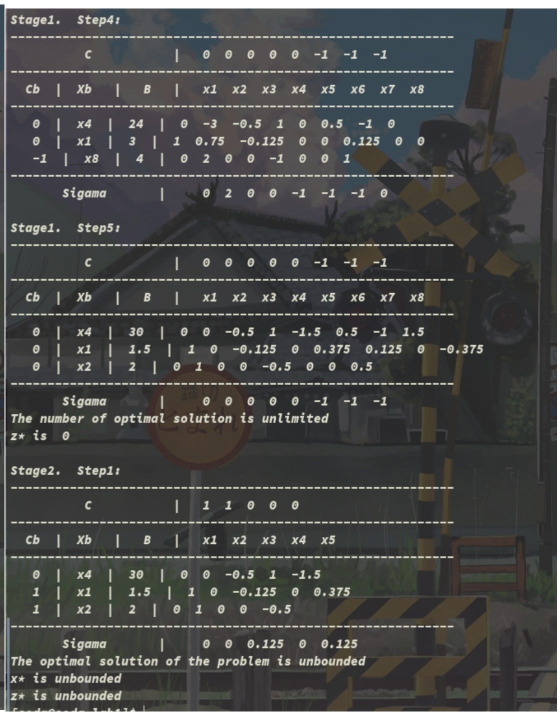


```
[soda@soda lab1]$ ./simplex
1
3 2
1 1
8 6 24 2
4 6 -12 2
0 2 4 2

Stage1.  Step1:
------------------------------------------------------------
         C            |   0  0  0  0  0  -1  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7  x8
------------------------------------------------------------
   -1  |  x6  |  24  |  8  6  -1  0  0  1  0  0
   -1  |  x7  |  -12  |  4  6  0  -1  0  0  1  0
   -1  |  x8  |  4  |  0  2  0  0  -1  0  0  1
------------------------------------------------------------
      Sigama        |   12  14  -1  -1  -1  0  0  0

Stage1.  Step2:
------------------------------------------------------------
         C            |   0  0  0  0  0  -1  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7  x8
------------------------------------------------------------
   -1  |  x6  |  36  |  4  0  -1  1  0  1  -1  0
   0  |  x2  |  -2  |  0.666667  1  0  -0.166667  0  0  0.166667  0
   -1  |  x8  |  8  |  -1.33333  0  0  0.333333  -1  0  -0.333333  1
------------------------------------------------------------
      Sigama        |2.66667  0  -1  1.33333  -1  0  -2.33333  0

Stage1.  Step3:
------------------------------------------------------------
         C            |   0  0  0  0  0  -1  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7  x8
------------------------------------------------------------
   -1  |  x6  |  48  |  0  -6  -1  2  0  1  -2  0
   0  |  x1  |  -3  |  1  1.5  0  -0.25  0  0  0.25  0
   -1  |  x8  |  4  |  0  2  0  0  -1  0  0  1
------------------------------------------------------------
      Sigama        |   0  -4  -1  2  -1  0  -3  0
```

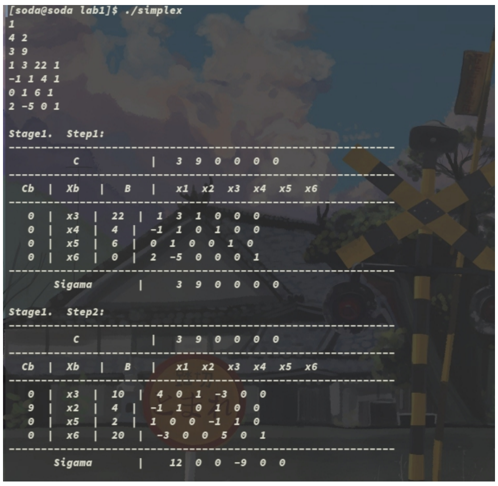


```
Stage1.  Step4:
------------------------------------------------------------
         C            |   0  0  0  0  0  -1  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7  x8
------------------------------------------------------------
   0  |  x4  |  24  |  0  -3  -0.5  1  0  0.5  -1  0
   0  |  x1  |  3  |  1  0.75  -0.125  0  0  0.125  0  0
   -1  |  x8  |  4  |  0  2  0  0  -1  0  0  1
------------------------------------------------------------
      Sigama        |   0  2  0  0  -1  -1  -1  0

Stage1.  Step5:
------------------------------------------------------------
         C            |   0  0  0  0  0  -1  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7  x8
------------------------------------------------------------
   0  |  x4  |  30  |  0  0  -0.5  1  -1.5  0.5  -1  1.5
   0  |  x1  |  1.5  |  1  0  -0.125  0  0.375  0.125  0  -0.375
   0  |  x2  |  2  |  0  1  0  0  -0.5  0  0  0.5
------------------------------------------------------------
      Sigama        |   0  0  0  0  0  -1  -1  -1
The number of optimal solution is unlimited
z* is  0

Stage2.  Step1:
------------------------------------------------------------
         C            |   1  1  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5
------------------------------------------------------------
   0  |  x4  |  30  |  0  0  -0.5  1  -1.5
   1  |  x1  |  1.5  |  1  0  -0.125  0  0.375
   1  |  x2  |  2  |  0  1  0  0  -0.5
------------------------------------------------------------
      Sigama        |   0  0  0.125  0  0.125
The optimal solution of the problem is unbounded
x* is unbounded
z* is unbounded
```

1d)

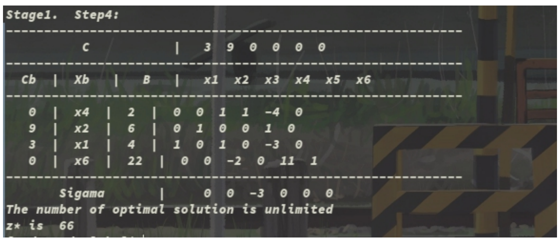


```
[soda@soda lab1]$ ./simplex
1
4 2
3 9
1 3 22 1
-1 1 4 1
0 1 6 1
2 -5 0 1

Stage1.  Step1:
------------------------------------------------------------
         C            |   3  9  0  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x3  |  22  |  1  3  1  0  0  0
   0  |  x4  |  4  |  -1  1  0  1  0  0
   0  |  x5  |  6  |  0  1  0  0  1  0
   0  |  x6  |  0  |  2  -5  0  0  0  1
------------------------------------------------------------
      Sigama        |   3  9  0  0  0  0

Stage1.  Step2:
------------------------------------------------------------
         C            |   3  9  0  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x3  |  10  |  4  0  1  -3  0  0
   9  |  x2  |  4  |  -1  1  0  1  0  0
   0  |  x5  |  2  |  1  0  0  -1  1  0
   0  |  x6  |  20  |  -3  0  0  5  0  1
------------------------------------------------------------
      Sigama        |   12  0  0  -9  0  0
```

```
Stage1.  Step3:
------------------------------------------------------------
         C            |   3  9  0  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x3  |  2  |  0  0  1  1  -4  0
   9  |  x2  |  6  |  0  1  0  0  1  0
   3  |  x1  |  2  |  1  0  0  -1  1  0
   0  |  x6  |  26  |  0  0  0  2  3  1
------------------------------------------------------------
      Sigama        |   0  0  0  3  -12  0
```



```
Stage1.  Step4:
------------------------------------------------------------
         C            |   3  9  0  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   0  |  x4  |  2  |  0  0  1  1  -4  0
   9  |  x2  |  6  |  0  1  0  0  1  0
   3  |  x1  |  4  |  1  0  1  0  -3  0
   0  |  x6  |  22  |  0  0  -2  0  11  1
------------------------------------------------------------
      Sigama        |   0  0  -3  0  0  0
The number of optimal solution is unlimited
z* is  66
```

2a)

```
[soda@soda lab1]$ ./simplex
1
3 3
4 5 1
3 2 1 18 2
2 1 0 4 1
1 1 -1 5 0

Stage1.  Step1:
------------------------------------------------------------
         C           |   0  0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7
------------------------------------------------------------
   -1  |  x6  |  18  |  3  2  1  -1  0  1  0
   0  |  x5  |  4  |  2  1  0  0  1  0  0
   -1  |  x7  |  5  |  1  1  -1  0  0  0  1
------------------------------------------------------------
       Sigama        |    4  3  0  -1  0  0  0

Stage1.  Step2:
------------------------------------------------------------
         C           |   0  0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7
------------------------------------------------------------
   -1  |  x6  |  12  |  0  0.5  1  -1  -1.5  1  0
   0  |  x1  |  2  |  1  0.5  0  0  0.5  0  0
   -1  |  x7  |  3  |  0  0.5  -1  0  -0.5  0  1
------------------------------------------------------------
       Sigama        |    0  1  0  -1  -2  0  0

Stage1.  Step3:
------------------------------------------------------------
         C           |   0  0  0  0  0  -1  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7
------------------------------------------------------------
   -1  |  x6  |  10  |  -1  0  1  -1  -2  1  0
   0  |  x2  |  4  |  2  1  0  0  1  0  0
   -1  |  x7  |  1  |  -1  0  -1  0  -1  0  1
------------------------------------------------------------
       Sigama        |   -2  0  0  -1  -3  0  0
The problem doesn't has a feasible solution.
```

2b)

```
[soda@soda lab1]$ ./simplex
1
3 3
2 1 1
4 2 2 4 2
2 4 0 20 1
4 8 2 16 1

Stage1.  Step1:
------------------------------------------------------------
         C           |   0  0  0  0  0  0  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7
------------------------------------------------------------
   -1  |  x7  |  4  |  4  2  2  -1  0  0  1
   0  |  x5  |  20  |  2  4  0  0  1  0  0
   0  |  x6  |  16  |  4  8  2  0  0  1  0
------------------------------------------------------------
       Sigama        |    4  2  2  -1  0  0  0

Stage1.  Step2:
------------------------------------------------------------
         C           |   0  0  0  0  0  0  -1
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6  x7
------------------------------------------------------------
   0  |  x1  |  1  |  1  0.5  0.5  -0.25  0  0  0.25
   0  |  x5  |  18  |  0  3  -1  0.5  1  0  -0.5
   0  |  x6  |  12  |  0  6  0  1  0  1  -1
------------------------------------------------------------
       Sigama        |    0  0  0  0  0  0  -1
The number of optimal solution is unlimited
z* is  0
```

```
Stage2.  Step1:
------------------------------------------------------------
         C           |   2  1  1  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   2  |  x1  |  1  |  1  0.5  0.5  -0.25  0  0
   0  |  x5  |  18  |  0  3  -1  0.5  1  0
   0  |  x6  |  12  |  0  6  0  1  0  1
------------------------------------------------------------
       Sigama        |    0  0  0  0.5  0  0
```

```
Stage2.  Step2:
------------------------------------------------------------
         C           |   2  1  1  0  0  0
------------------------------------------------------------
  Cb  |  Xb   |   B   |   x1  x2  x3  x4  x5  x6
------------------------------------------------------------
   2  |  x1  |  4  |  1  2  0.5  0  0  0.25
   0  |  x5  |  12  |  0  0  -1  0  1  -0.5
   0  |  x4  |  12  |  0  6  0  1  0  1
------------------------------------------------------------
       Sigama        |    0  -3  0  0  0  -0.5
The number of optimal solution is unlimited
z* is  8
```