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Example3.6Cycling

```
load simplex.sage
```

```
simplex functions loaded.
```

```
A=Matrix([[3,-3/4,20,-1/2,6,0,0,0],[0,1/4,-8,-1,9,1,0,0],
[0,1/2,-12,-1/2,3,0,1,0],[1,0,0,1,0,0,0,1]]); Aorig=copy(A); A
```

```
[ 3 -3/4 20 -1/2 6 0 0 0]
[ 0 1/4 -8 -1 9 1 0 0]
[ 0 1/2 -12 -1/2 3 0 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
B=[5,6,7]
```

```
pivot(A,1,1,B); A; A==Aorig
```

```
Pivoting tableau on col= 1 row= 1
```

```
[ 3 0 -4 -7/2 33 3 0 0]
[ 0 1 -32 -4 36 4 0 0]
[ 0 0 4 3/2 -15 -2 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
False
```

```
pivot(A,2,2,B); A
```

```
Pivoting tableau on col= 2 row= 2
```

```
[ 3 0 0 -2 18 1 1 0]
[ 0 1 0 8 -84 -12 8 0]
[ 0 0 1 3/8 -15/4 -1/2 1/4 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,3,1,B); A
```

```
Pivoting tableau on col= 3 row= 1
```

```
[ 3 1/4 0 0 -3 -2 3 0]
[ 0 1/8 0 1 -21/2 -3/2 1 0]
[ 0 -3/64 1 0 3/16 1/16 -1/8 0]
[ 1 -1/8 0 0 21/2 3/2 -1 1]
```

```
pivot(A,4,2,B); A
```

Pivoting tableau on col= 4 row= 2

```
[ 3 -1/2 16 0 0 -1 1 0]
[ 0 -5/2 56 1 0 2 -6 0]
[ 0 -1/4 16/3 0 1 1/3 -2/3 0]
[ 1 5/2 -56 0 0 -2 6 1]
```

```
pivot(A,5,1,B); A
```

```
Pivoting tableau on col= 5 row= 1
```

```
[ 3 -7/4 44 1/2 0 0 -2 0]
[ 0 -5/4 28 1/2 0 1 -3 0]
[ 0 1/6 -4 -1/6 1 0 1/3 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,6,2,B); A; A==Aorig
```

```
Pivoting tableau on col= 6 row= 2
```

```
[ 3 -3/4 20 -1/2 6 0 0 0]
[ 0 1/4 -8 -1 9 1 0 0]
[ 0 1/2 -12 -1/2 3 0 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
True
```

```
# For lexicographic pivoting rules:
```

```
A
```

```
[ 3 -3/4 20 -1/2 6 0 0 0]
[ 0 1/4 -8 -1 9 1 0 0]
[ 0 1/2 -12 -1/2 3 0 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
scale_rows(A,1)
```

```
Scaling rows so that every positive entry in the pivot
1.
```

```
[ 3 -3/4 20 -1/2 6 0 0 0]
[ 0 1 -32 -4 36 4 0 0]
[ 0 1 -24 -1 6 0 2 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,1,1,B); A
```

```
Pivoting tableau on col= 1 row= 1
```

```
[ 3 0 -4 -7/2 33 3 0 0]
[ 0 1 -32 -4 36 4 0 0]
[ 0 0 4 3/2 -15 -2 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
scale_rows(A,2)
```

```
Scaling rows so that every positive entry in the pivot
1.
```

$$\begin{bmatrix} 3 & 0 & -4 & -7/2 & 33 & 3 & 0 & 0 \\ 0 & 1 & -32 & -4 & 36 & 4 & 0 & 0 \\ 0 & 0 & 1 & 3/8 & -15/4 & -1/2 & 1/4 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

`pivot(A,2,2,B); A`

Pivoting tableau on col= 2 row= 2

$$\begin{bmatrix} 3 & 0 & 0 & -2 & 18 & 1 & 1 & 0 \\ 0 & 1 & 0 & 8 & -84 & -12 & 8 & 0 \\ 0 & 0 & 1 & 3/8 & -15/4 & -1/2 & 1/4 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

`scale_rows(A,3)`

Scaling rows so that every positive entry in the pivot 1.

$$\begin{bmatrix} 3 & 0 & 0 & -2 & 18 & 1 & 1 & 0 \\ 0 & 1/8 & 0 & 1 & -21/2 & -3/2 & 1 & 0 \\ 0 & 0 & 8/3 & 1 & -10 & -4/3 & 2/3 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

`pivot(A,3,2,B); A`

Pivoting tableau on col= 3 row= 2

$$\begin{bmatrix} 3 & 0 & 16/3 & 0 & -2 & -5/3 & 7/3 & 0 \\ 0 & 1 & -64/3 & 0 & -4 & -4/3 & 8/3 & 0 \\ 0 & 0 & 8/3 & 1 & -10 & -4/3 & 2/3 & 0 \\ 1 & 0 & -8/3 & 0 & 10 & 4/3 & -2/3 & 1 \end{bmatrix}$$

`scale_rows(A,5)`

Scaling rows so that every positive entry in the pivot 1.

$$\begin{bmatrix} 3 & 0 & 16/3 & 0 & -2 & -5/3 & 7/3 & 0 \\ 0 & 1 & -64/3 & 0 & -4 & -4/3 & 8/3 & 0 \\ 0 & 0 & 8/3 & 1 & -10 & -4/3 & 2/3 & 0 \\ 3/4 & 0 & -2 & 0 & 15/2 & 1 & -1/2 & 3/4 \end{bmatrix}$$

`pivot(A,5,3,B); A`

Pivoting tableau on col= 5 row= 3

$$\begin{bmatrix} 17/4 & 0 & 2 & 0 & 21/2 & 0 & 3/2 & 5/4 \\ 1 & 1 & -24 & 0 & 6 & 0 & 2 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 0 & 1 \\ 3/4 & 0 & -2 & 0 & 15/2 & 1 & -1/2 & 3/4 \end{bmatrix}$$

For Bland's Rule

```
A=copy(Aorig); A
```

```
[ 3 -3/4 20 -1/2 6 0 0 0]
[ 0 1/4 -8 -1 9 1 0 0]
[ 0 1/2 -12 -1/2 3 0 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,1,1,B); A
```

```
Pivoting tableau on col= 1 row= 1
```

```
[ 3 0 -4 -7/2 33 3 0 0]
[ 0 1 -32 -4 36 4 0 0]
[ 0 0 4 3/2 -15 -2 1 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,2,2,B); A
```

```
Pivoting tableau on col= 2 row= 2
```

```
[ 3 0 0 -2 18 1 1 0]
[ 0 1 0 8 -84 -12 8 0]
[ 0 0 1 3/8 -15/4 -1/2 1/4 0]
[ 1 0 0 1 0 0 0 1]
```

```
pivot(A,3,1,B); A
```

```
Pivoting tableau on col= 3 row= 1
```

```
[ 3 1/4 0 0 -3 -2 3 0]
[ 0 1/8 0 1 -21/2 -3/2 1 0]
[ 0 -3/64 1 0 3/16 1/16 -1/8 0]
[ 1 -1/8 0 0 21/2 3/2 -1 1]
```

```
pivot(A,4,2,B); A
```

```
Pivoting tableau on col= 4 row= 2
```

```
[ 3 -1/2 16 0 0 -1 1 0]
[ 0 -5/2 56 1 0 2 -6 0]
[ 0 -1/4 16/3 0 1 1/3 -2/3 0]
[ 1 5/2 -56 0 0 -2 6 1]
```

```
pivot(A,1,3,B); A
```

```
Pivoting tableau on col= 1 row= 3
```

```
[ 16/5 0 24/5 0 0 -7/5 11/5 1/5]
[ 1 0 0 1 0 0 0 0]
[ 1/10 0 -4/15 0 1 2/15 -1/15 1/15]
[ 2/5 1 -112/5 0 0 -4/5 12/5 2/5]
```

```
pivot(A,5,2,B); A
```

Pivoting tableau on col= 5 row= 2

[17/4	0	2	0	21/2	0	3/2	5/4]
[1	0	0	1	0	0	0	1]
[3/4	0	-2	0	15/2	1	-1/2	3/4]
[1	1	-24	0	6	0	2	1]

