Calculations for Example 2.5.5(c)

Calculations for Example 2.5.5(c) on page 73.

```
s=var('s')
f=(1/s)^s * (1/(3*s-1))^(3*s-1) * (1/(1-2*s))^(1-2*s) *
(1/(1-2*s))^(1-2*s)
logf=s*(-log(s)) + (3*s-1)*(-log(3*s-1)) + 2*(1-2*s)*(-log(1-2*s))
logfd=logf.diff(s)
delta1=find_root(logfd,1/3,1/2); delta1
```

```
0.39220293076261781
```

Hence $\delta_1 = 0.39220293076261781$ gives us δ^*, the optimal solution to the dual geometric program (DGP).

```
deltaStar=vector([0,-1,1,1])+delta1*vector([1,3,-2,-2])
deltaStar
```

```
(0.392202930763, 0.176608792288, 0.215594138475, 0.215594138475)
```

The optimum objective value of DGP is $v(\delta^*)$.

```
v=1  # v(deltaStar)
for i in range(4):
   v*=deltaStar[i]^(-deltaStar[i])
v
```

```
3.7996047536
```

We now solve for the minimizer $\mathbf{t}^*$ of $g(\mathbf{t})$ using the *log* of the equations $\delta_i^* = \frac{u_i(\mathbf{t}^*)}{v(\delta^*)}$ for $i = 1, \ldots, n$.

```
A=matrix(RDF,4,2,[[-1,-1],[1,1],[1,0],[0,1]]); A
```

```
[-1.0 -1.0]
[ 1.0  1.0]
[ 1.0  0.0]
[ 0.0  1.0]
```

```
b=vector([log(deltaStar[i])+log(v) for i in range(4)]); b
```

```
(0.398921156486, -0.398921156486, -0.199460578243, -0.199460578243)
```

We wish to solve the linear system $A\mathbf{x} = b$, where $\mathbf{x} = \begin{bmatrix} \log(t_1^*) \\ \log(t_2^*) \end{bmatrix}$. Note that we can just read off the solution $\log(t_1^*) = \log(t_2^*) = -0.199460578243$.

```
t1Star=exp(b[2]); t1Star
```

```
0.819172513396
```

Thus, $(t_1^*, t_2^*) = (.81917, .81917)$ and $g(\mathbf{t}^*) = 3.7996$.