CS 524 - Homework 8

Question 2a

first step is to express this as a geometric program:

$$\begin{aligned} \text{maximize} \quad & \alpha_4 T r^2 \\ \text{subject to} \quad & \frac{\alpha_1 T r}{w} + \alpha_2 r + \alpha_3 r w \leq C_{max} \\ & T_{min} \leq T \leq T_{max} \\ & r_{min} \leq r \leq r_{max} \\ & w_{min} \leq w \leq w_{max} \\ & w \leq 0.1r \end{aligned}$$

to convert to a convex optimization program we use the following: $x = \log T \quad y = \log r \quad z = \log w$

$$\begin{aligned} \text{maximize} \quad & \log \alpha_4 + x + 2y \\ \text{subject to} \quad & \log(e^{\log \alpha_1 + x + y - z} + e^{\log \alpha_2 + y} + e^{\log \alpha_3 + y + z}) \leq \log C_{max} \\ & \log T_{min} \leq x \leq \log T_{max} \\ & \log r_{min} \leq y \leq \log r_{max} \\ & \log w_{min} \leq z \leq \log w_{max} \\ & z \leq \log 0.1 + y \end{aligned}$$

Question 2b

In [8]:
```
using JuMP, Ipopt

α1 = α2 = α3 = α4 = 1
C = 500

m_heatflow = Model(with_optimizer(Ipopt.Optimizer, print_level=0))

@variable(m_heatflow, x)
@variable(m_heatflow, y)
```

```julia
@variable(m_heatflow, z)

@NLconstraint(m_heatflow, log(exp(x+y-z) + exp(y) + exp(y+z)) <= log(C))

@constraint(m_heatflow, z <= log(0.1) + y)
@objective(m_heatflow, Max, x + 2y)

optimize!(m_heatflow)

println("T: ", exp(value(x)))
println("r: ", exp(value(y)))
println("w: ", exp(value(z)))
println("Max Heat Flow: ", objective_value(m_heatflow))
```

```
T: 23.840239447809125
r: 46.390428083369095
w: 4.63904279465654
Max Heat Flow: 10.845561179387495
```

```
In [ ]:
```