

HW9

```
(opt) prial@MacBook-Prial HW9 % python hw91.py
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iteration 1 obj = 18.0 u = [2.0, 2.0] penalties = [0.0, 1.0]
iteration 2 obj = 17.0 u = [2.0, 1.0] penalties = [0.0, 1.0]
iteration 3 obj = 16.5 u = [2.0, 0.5] penalties = [0.0, 1.0]
iteration 4 obj = 16.1666666667 u = [2.0, 0.16666666666666669] penalties = [0.0, 1.0]
iteration 5 obj = 16.0 u = [2.0, 0.0] penalties = [0.0, 1.0]
primal feasible & optimal
objective = 16.0
x1: 1.000000
x2: 0.000000
x3: 0.000000
x4: 0.000000
C4: 0.000000
C5: 1.000000
```

1.

```
current gap: 19.709598052044534
current gap: 19.729194526067737
current gap: 19.707202946666882
current gap: 19.726813584079164
current gap: 19.706100901789476
current gap: 19.710812638962324
current gap: 19.72346045368855
current gap: 19.70446330532421
current gap: 19.71214838689714
better feasible found
current gap: 0.31822925072845915
smaller than desired gap
--- Model generation time: 1.62802100182 seconds ---
--- Model solution time: 149.520452023 seconds ---
```

2.

```
current gap: 12.115750400072624
current gap: 12.105535344275498
current gap: 12.019015747084172
current gap: 11.967709447988472
current gap: 11.940538390605496
current gap: 12.00583980516249
current gap: 11.939637366529544
current gap: 12.007256655609138
current gap: 11.934400073021887
current gap: 11.92248361381374
current gap: 12.01131215150889
current gap: 11.925222132038346
current gap: 12.002201282596358
current gap: 11.937630725633742
better feasible found
current gap: 0.01049641598338595
smaller than desired gap
--- Model generation time: 0.680199861526 seconds ---
--- Model solution time: 78.9808650017 seconds ---
```

3.

From the result of weak formulation and strong formulation, the gaps gradually decrease every iteration until the better feasible found the gap then significantly decrease. The solution time depend on the random feasible objective value.