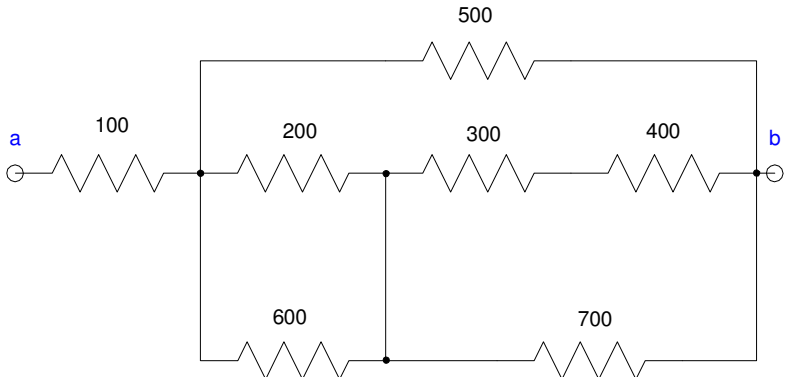
# ECE 476/676 - Homework #2

*Loops, if-Statements, Subroutines - Due Monday, September 8th*

1) Using Python subroutines, determine the resistance Rab



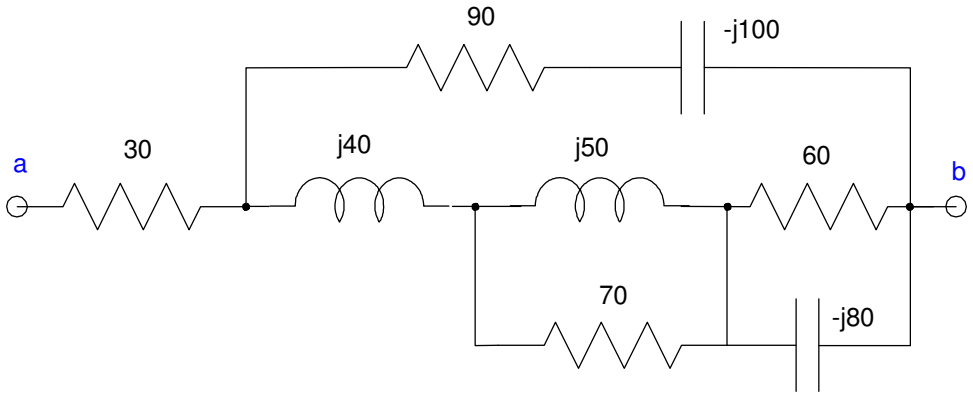

Python Code

```
def Series(R1, R2):
    R3 = R1 + R2
    return(R3)

def Parallel(R1, R2):
    R3 = 1 / (1/R1 + 1/R2)
    return(R3)

Ra = Series(300, 400)
Rb = Parallel(Ra, 700)
Rc = Parallel(200, 600)
Rd = Series(Rb, Rc)
Re = Parallel(Rd, 500)
Rab = Series(Re, 100)
print('Rab =  ', Rab)
```

Shell Window

```
>>> %Run -c $EDITOR_CONTENT

MPY: soft reboot
Rab =   350.0
```

2) Using Python subroutines, determine the resistance Zab




Python program

```
def Series(R1, R2):
    R3 = R1 + R2
    return(R3)

def Parallel(R1, R2):
    R3 = 1 / (1/R1 + 1/R2)
    return(R3)

Za = Parallel(60, -80j)
Zb = Parallel(70, 50j)
Zc =  Series(Za, Zb)
Zd = Series(Zc, 40j)
Ze = Parallel(Zd, 90-100j)
Zab = Series(Ze, 30)

print('Zab = ', Zab)
```

Shell Window

```
>>> %Run -c $EDITOR_CONTENT

MPY: soft reboot
Zab =  (92.785992+8.415304j)
```

3) A and B are playing a dice game.

- Player A takes the sum of five 12-sided dice (5d12)
- Player B takes the sum of three 20-sided dice (3d20)

Whoever has the higher total wins.

Write a Python program to play a single games. Give the results for playing five games (check that the results change game to game)

```
# Sample Code:
from random import randrange
d12 = randrange(1,12)
d20 = randrange(1,20)
```

Python Code

```
#Problem 3
from random import randrange
W = T = L = 0
for i in range(0,5):
    A = B = 0
    for j in range(0,5):
        A += randrange(1,12)
    for j in range(0,3):
        B += randrange(1,20)
    if(A>B):
        W += 1
    elif(A == B):
        T += 1
    else:
        L += 1
    print(A, B, W, T, L)
```

Shell Window

```
A  B  W T L
27 42 0 0 1
30 31 0 0 2
48 13 1 0 2
12 22 1 0 3
26 37 1 0 4
```

4) Using Python along with a Monte-Carlo simulation with 10,000 matches, determine the probability that A wins if each match is the best of 5 games. (for-loops)

Python Code

```
# Problem #4
from random import randrange
W = T = L = 0
for match in range(0,1e4):
    W0 = T0 = L0 = 0
    for i in range(0,5):
        A = B = 0
        for j in range(0,5):
            A += randrange(1,12)
        for j in range(0,3):
            B += randrange(1,20)
        if(A>B):
            W0 += 1
        elif(A == B):
            T0 += 1
        else:
            L0 += 1
    if(W0 > L0):
        W += 1
    elif(W0 == L0):
        T += 1
    else:
        L += 1
print(W, T, L)
```

Shell Window

```
   W  T    L
4760 534 4706
```

A has a

- 47.60% chance of winning
- 5.34% chance of a tie
- 47.06% chance of losing

5) Using Python along with a Monte-Carlo simulation with 10,000 matches, determine the probability that A wins if each match continues until one player is up by three games (while loop)

Python Code

```
from random import randrange
W = T = L = 0
for match in range(0,1e4):
    W0 = T0 = L0 = A = B = 0
    while(abs(W0-L0) < 3):
        A = B = 0
        for j in range(0,5):
            A += randrange(1,12)
        for j in range(0,3):
            B += randrange(1,20)
        if(A>B):
            W0 += 1
        elif(A == B):
            T0 += 1
        else:
            L0 += 1
    if(W0 > L0):
        W += 1
    elif(W0 == L0):
        T += 1
    else:
        L += 1
    #print(W0, L0, W, T, L)
print(W, T, L)
```

Shell Window

```
   W  T  L
5026 0 4974
```

With this format,

- A wins 50.26% of the time
- Never ties
- Loses 49.74% of the time