ECE 476/676 - Homework #2
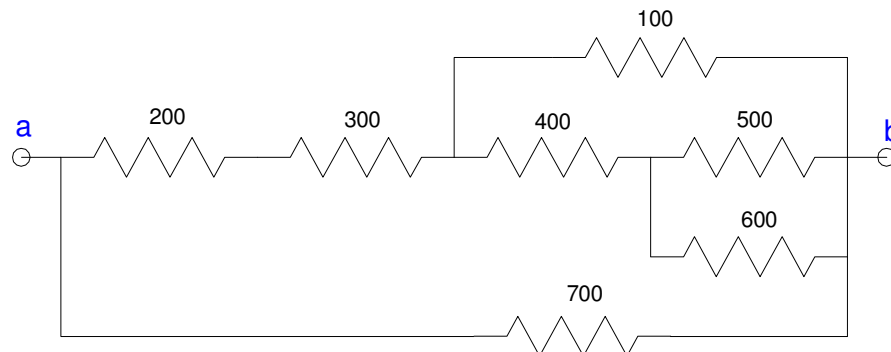
Loops, if-Statements, Subroutines - Due Monday, January 27th

1) Using Python subroutines, determine the resistance Rab

Create subroutines for series and parallel:

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

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

R1 = Parallel(500, 600)
R2 = Series(R1, 400)
R3 = Parallel(R2, 100)
R4 = Series(R3, 300)
R5 = Series(R4, 200)
R6 = Parallel(R5, 700)
print('Rab = ',R6)
```
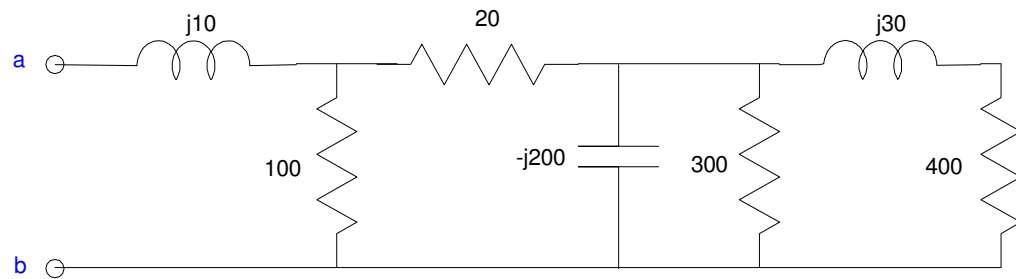
shell

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

MPY: soft reboot
Rab =  319.287
```

The total resistance is Rab = 319.287 Ohms

Python works with real numbers

2) Using Python subroutines, determine the resistance Zab


```
# Problem 2

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

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

j = (-1) ** 0.5
R1 = Series(400, 30*j)
R2 = Parallel(R1, 300)
R3 = Parallel(R2, -200*j)
R4 = Series(R3, 20)
R5 = Parallel(R4, 100)
R6 = Series(R5, j*10)
print('Rab = ',R6)
```

shell

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

MPY: soft reboot
Rab =  (60.64711-4.958437j)
```

The total resistance is 60.64711 -j4.958437 Ohms

Python works with complex numbers as well

3) A and B are playing a dice game.

  • Player A takes the sum of four 10-sided dice (4d10)
  • Player B takes the sum of eight 6-sided dice (8d6)

Whoever has the higher total wins.

Write a Python program to play the game one time. Give the results after playing five games.

```python
#Problem 3
from random import randrange
W = T = L = 0
for i in range(0,5):
    A = B = 0
    for j in range(0,4):
        A += randrange(1,11)
    for j in range(0,8):
        B += randrange(1,7)
    if(A>B):
        W += 1
    elif(A == B):
        T += 1
    else:
        L += 1

print(W, T, L)
```

shell

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

MPY: soft reboot
1 0 4
>>>
```

A lost the math 1 game to 4 (varies each time you run the code)

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)

```
# 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(0,4):
            A += randrange(1,11)
        for j in range(0,8):
            B += randrange(1,7)
        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

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

MPY: soft reboot
533 260 9207
>>>
```

A won 5.33% of the time,

tied 2.60% of the time, and

lost 92.07% of the time

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 two games (while loop)

```
# Problem 5
from random import randrange
W = T = L = 0
for match in range(0,1e4):
    W0 = T0 = L0 = A = B = 0
    while(abs(W0-L0) < 2):
        A = B = 0
        for j in range(0,4):
            A += randrange(1,11)
        for j in range(0,8):
            B += randrange(1,7)
        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

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

MPY: soft reboot
591  0  9409
```

A won 5.91% of the time

tied 0% of the time, and

lost 94.09% of the time