MCS 260: Homework 2

cs,homework,logic

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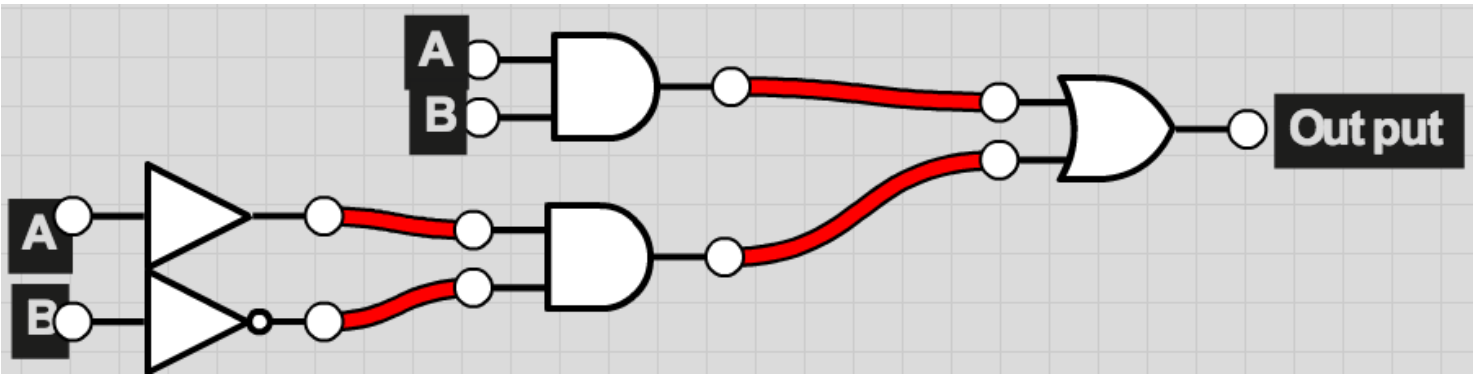
1) For the following Python expression, write down the corresponding truth table and a logic gate diagram.

```
>>> (A and B) or (A and not B)
```



Truth Table

A	B	A and B	A and not B	(A and B) or (A and not B)
1	0	0	1	1
0	1	0	0	0
0	0	0	0	0

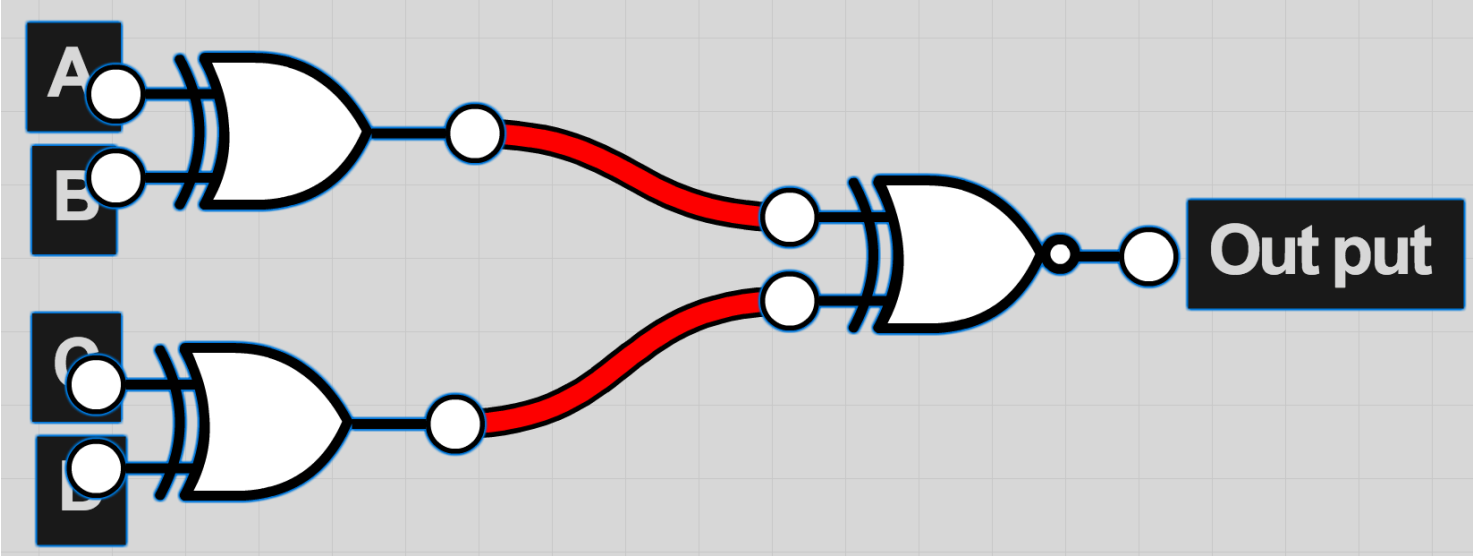
2.

Rule: Given four boolean inputs `A`, `B`, `C`, and `D`, the output is 1 if an even number of inputs is 1, and the output is 0 otherwise.

Truth Table

A	B	C	D	E
1	1	1	0	0
1	1	0	1	0

1	0	1	1	0
0	1	1	1	0
1	1	0	0	1
1	0	0	1	1
0	0	1	1	1
0	1	1	0	1
0	0	0	1	0
0	0	1	0	0
0	1	0	0	0
1	0	0	0	0
0	0	0	0	1
0	1	0	1	1
1	0	1	0	1

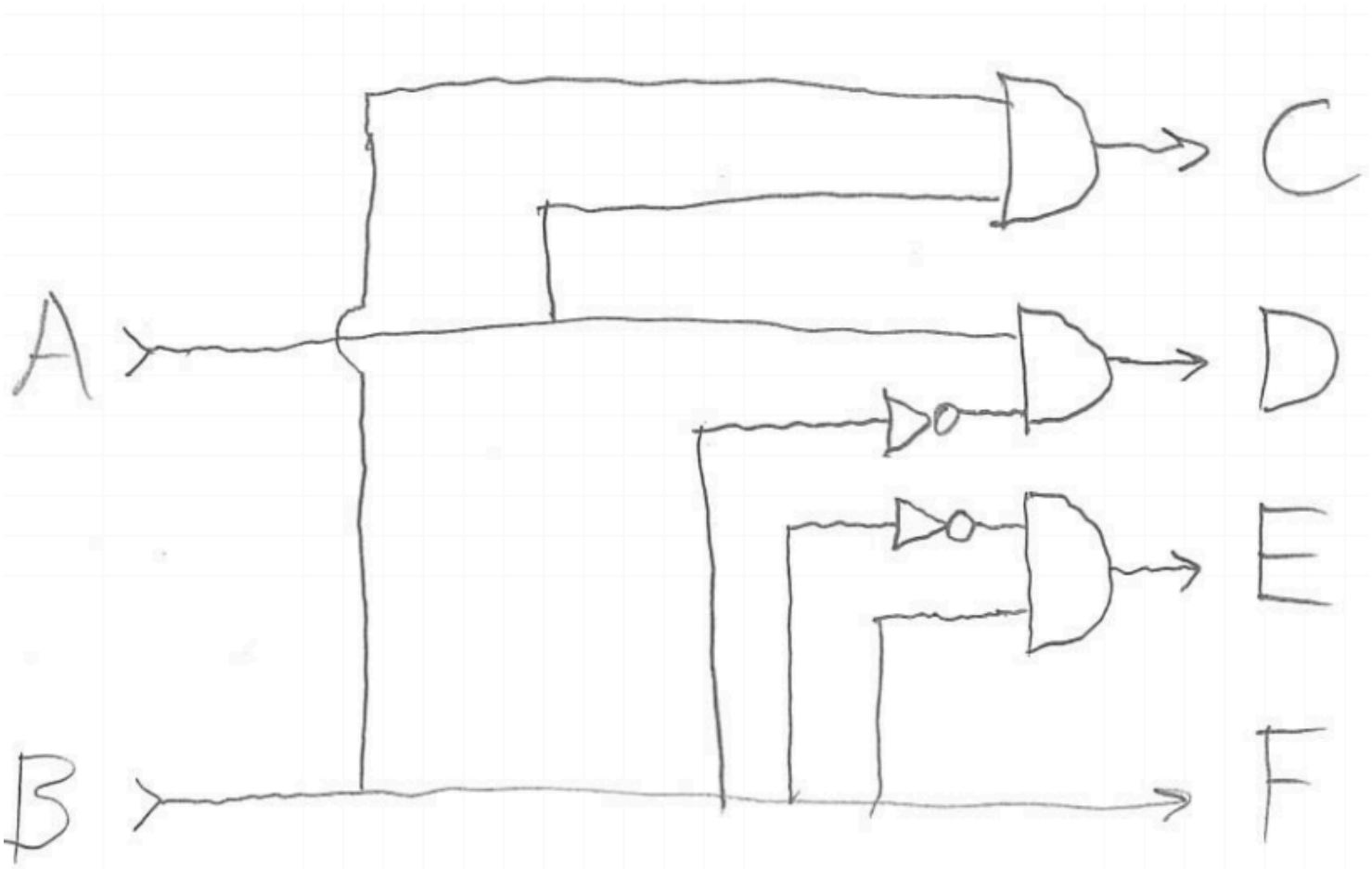


Python Equivalent

```python
def XOR(a, b):
    if a != b:
        return True
    else:
        return False

def XNOR(a, b):
```

```
    return not XOR(a, b)

def parity_bit(a, b, c, d):
    """Homework answer to problem 2. """

    return XNOR(XOR(a, b), XOR(c, d))
```

3. Logic Gate



Truth Table

A	B	C	D	E	F
1	0	0	1	0	0
1	1	1	0	0	1
0	0	0	0	0	0
0	1	0	0	0	1

4) Consider the following Python code:

```
>>> L = [1, 2, 1, 3]
>>> i = 1
>>> value = L[-i]
>>> while i < len(L):
        i += 1
        value = L[-i] + 1/value
>>> final_value = value
>>> print(final_value)
```

Fill out the following state table (on your own piece of paper), where step 0 is before the while loop has started, step 1 is after one loop, etc. ONLY use integers and fractions to fill out the table.

step	i	L[-i]	value
0			
1			
⋮			

final_value = ?

In addition, if L were ANY list of four numbers, what equation does final_value represent as a function of the list elements L[0], L[1], L[2], and L[3]? Write down a single expression of the form

final_value = (*big equation with* L[0], L[1], L[2], L[3])

$\frac{3*(L[1]+L[3]}{(10*L[0]+L[2])} = \frac{15}{11}$

```
1 >>> final_value = (3*(L[1] + L[3]))/(10*L[0] + L[2])
2 >>> final_value
3 1.3636363636363635
```

1.3636363636363635 ~ $\frac{15}{11}$