

1. Let

$A = \{1, 2, 3, 5, 10\}$

$B = \{2, 4, 7, 8, 9\}$

$C = \{5, 8, 10\}$

be subsets of $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Please find

(a) $B \cup A$

(b) $A - C$

(c) $B' \cap (A \cup C)$

In [9]:

```
#(a)
A = {1, 2, 3, 5, 10}
B = {2, 4, 7, 8, 9}
B.union(A)
```

Out[9]: {1, 2, 3, 4, 5, 7, 8, 9, 10}

In [8]:

```
#(b)
A = {1, 2, 3, 5, 10}
C = {5, 8, 10}
A.difference(C)
```

Out[8]: {1, 2, 3}

In [7]:

```
#(c)
S = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
B = {2, 4, 7, 8, 9}
A = {1, 2, 3, 5, 10}
C = {5, 8, 10}
NB = S.difference(B)
AC = A.union(C)
NB.intersection(AC)
```

Out[7]: {1, 3, 5, 10}

2. Let $A = \{1, 2\}$, and $B = \{3, 4\}$. Please

(a) Find $A \times B$

(b) Find $B \times A$

In [14]:

```
#(a)
print("(1, 3)")
print("(1, 4)")
print("(2, 3)")
print("(2, 4)")
```

(1, 3)

(1, 4)

(2, 3)

(2, 4)

```
In [15]: #(b)
print("(3,1)")
print("(3,2)")
print("(4,1)")
print("(4,2)")
```

```
(3,1)
(3,2)
(4,1)
(4,2)
```

3. How many three-letter words (not necessarily meaningful) can be formed from the word "compiler" if no letters can be repeated?

```
In [ ]: n = 8
r = 3
P(8,3) = n!/(n-r)! = 8!/5! = 8*7*6 = 336
```

4. How many 5-card poker hands are possible with a 52-card deck?

```
In [3]: import math
def fact(n):
    if (n <= 1):
        return 1
    return n * fact(n - 1)
```

```
In [ ]: n = 52
r = 5
C(52,5) = n!/((n-r)!*r!) = 52!/(47!*5!)
```

```
In [4]: fact(52)/(fact(47)*fact(5))
```

```
Out[4]: 2598960.0
```

5. Select all the statements in the following list

- (1) Be sure to wash your dishes after eating
- (2) Will there be tacos for dinner?
- (3) There are life forms on Jupiter.
- (4) $2 + 4 = 82$

- (1) No, it is a command, not a proposition
- (2) No, it is a question
- (3) Yes. It is a proposition.
- (4) Yes. It is a proposition.

6. How many rows will be in a truth table of a wff that contains 6 variables?

- A. 12
- B. 64
- C. 32
- D. 6

In [6]: `2**6`

Out[6]: 64

7. Negate the following:

- (1) $A \vee B$
- (2) You did not pass the class and you did not fail.
- (3) $A \rightarrow B$

$$(1) (A \vee B)' = A' \wedge B'$$

(2)

A: You did pass the class

B: You did fail the class

$$A' \wedge B'$$

$$(A' \wedge B')' = A \vee B$$

You did pass the class or you did fail the class

(3) $A \rightarrow B$

$$A' \vee B$$

$$(A' \vee B)' = A \wedge B'$$

8. Construct the truth tables for the following wffs.

(1) $(A \vee B)'$

(2) $A' \wedge B'$

(3) $(A \rightarrow B) \leftrightarrow (A' \vee B)'$

(4) $A \vee B \leftrightarrow (A' \rightarrow B)$

(1)

A	B	$A \vee B$	$(A \vee B)'$
T	T	T	F
T	F	T	F
F	T	T	F
F	F	F	T

(2)

A	B	A'	B'	$A' \wedge B'$
T	T	F	F	F
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

(3)

A	B	A'	$A \rightarrow B$	$A' \vee B$	$(A' \vee B)'$	$A \rightarrow B \leftrightarrow (A' \vee B)'$
T	T	F	T	T	F	F
T	F	F	F	F	T	F
F	T	T	T	T	F	F
F	F	T	T	T	F	F

(4)

A	B	A'	$A \vee B$	$A' \rightarrow B$	$A \vee B \leftrightarrow A' \rightarrow B$
T	T	F	T	T	T
T	F	F	T	T	T
F	T	T	T	T	T
F	F	T	F	F	T

9. List all wff in #3 that are tautologies or contradictions.

(3) is contradiction, (4) is tautology

10. List all paris of wffs in #3 that are equivalent

(1) and (2) are equivalent

11. Simplify the Boolean expression in the following piece of code

```
if( !(x == 2) || (y < z) || ( (y<z) && (x == 2) ))  
{  
  z++;  
}
```

A: $x == 2$

B: $y < z$

$(A' \vee B)' \vee (B \wedge A)$

$A \wedge B' \vee (B \wedge A)$

$(A \wedge B') \vee (A \wedge B)$

$A \wedge (B' \vee B)$

$A \wedge 1$

A

After the simplification, we got:

```
if(x==2) { z++;  
  
}
```

In []: