PROBLEM GROUP 1 *English $\mapsto$ Math*

Rewrite each of the following English sentences as an expression over propositions. Include both a mapping from symbols to propositions and the final expression.

1. Jim Ryan will have to give up being the president of UVA if Teresa Sullivan returns to UVA

2. I prefer oranges to apples, although apples are less messy to eat

3. If I forget my keys I can't get into the house unless my roommate is home.

4. If you can prove $P \neq NP$ (or $P = NP$, though I hope you don't), you'll become famous and I'll give you an A in this class

5. Python programmers must be lazy because Python programs are so much shorter than the equivalent Java or C++ programs

6. Python programs are so much shorter than the equivalent Java or C++ programs because Python programmers are lazy

7. Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted

8. Because we know that no general-purpose sorting algorithm can be faster than $O(n \log n)$, if you hear about any faster algorithm you can know it must be "cheating" somehow

PROBLEM GROUP 2 *If Statements*

Write an expression for when the following function returns the given return values. Use the parameters of the function as your propositions. Each function is shown in both Java and Python.

```python
def f(a,b,c):
    if a or b:
        return "one"
    elif c != a:
        return "two"
    else:
        return "three"
```

```java
public static String f(boolean a, boolean b, boolean c){
    if(a || b)
        return "one";
    else if(c != a)
        return "two";
    else
        return "three";
}
```

9. f returns "one" when _____

10. f returns "three" when _____

```python
def g(a,b):
    if a:
        return "left"
    elif b:
        return "right"
    else:
        return "up"
```

```java
public static String g(boolean a, boolean b){
    if(a)
        return "left";
    else if(b)
        return "right";
    else
        return "up";
}
```

11. g returns "right" when _____

12. g returns "up" when _____

Fill in the following truth tables

	A	B	C	$(A \lor C) \leftrightarrow (B \land C)$
	0	0	0	
	0	0	1	
	0	1	0	
13.	0	1	1	
	1	0	0	
	1	0	1	
	1	1	0	
	1	1	1	

	A	B	C	$(A \oplus B) \lor (A \oplus C) \lor (B \oplus C)$
	0	0	0	
	0	0	1	
	0	1	0	
14.	0	1	1	
	1	0	0	
	1	0	1	
	1	1	0	
	1	1	1	

	A	B	C	$(A \oplus C) \leftrightarrow (B \leftrightarrow C)$
	0	0	0	
	0	0	1	
	0	1	0	
15.	0	1	1	
	1	0	0	
	1	0	1	
	1	1	0	
	1	1	1	