Name: _____   CompID: _____

CS 2102 - DMT1 - Fall 2019 — Luther Tychonievich
Administered in class friday september 6, 2019

Quiz 01

PROBLEM 1 *English to logic*

Rewrite each of the following English sentences as an expression over propositions. Include both a mapping from symbols to propositions and the final expression. If there are ambiguities, explain where they arise, and give two non-equivalent interpretations.

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

   B: excessive bail required
   F: excessive fines imposed
   C: cruel punishments inflicted   — or —   P: cruel and unusual punishments inflicted
   U: unusual punishments inflicted
   $\neg B \wedge \neg F \wedge \neg(C \wedge U)$ — or — $\neg B \wedge \neg F \wedge \neg P$

   (incorrect to say $\neg B \wedge \neg F \wedge \neg C \wedge \neg U$, but give full points this time)

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

   S: Sullivan returns to UVA
   R: Ryan gives up presidency
   $S \rightarrow R$

   (OK to use "Ryan keeps presidency" and $\neg R$ instead)

3. 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

   K: We know no general-purpose sorting algorithm can be faster than $O(n \log n)$
   H: you hear of a faster algorithm
   C: "faster" algorithm is cheating
   $K \rightarrow (H \rightarrow C)$

   (half credit if only have one of the two implications)

PROBLEM 2 *If Statements*

Write an expression for when the following function returns the given return values. Use the variables a, b, and c as your propositions.

```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";
}
```

Returns *"one"* when $a \lor b$

Returns *"three"* when $\neg(a \lor b) \land \neg(c \oplus a)$
equivalently, $\bar{a} \land \bar{b} \land \bar{c}$

(half credit if answered for "two" instead: $\neg(a \lor b) \land (c \oplus a)$)

PROBLEM 3 *Truth Tables*

Fill in the following truth table (the dashed lines are just to help you line things up)

A	B	C	(A	⊕	C)	↔	(B	↔	C)
0	0	0		0		0		1	
0	0	1		1		0		0	
0	1	0		0		1		0	
0	1	1		1		1		1	
1	0	0		1		1		1	
1	0	1		0		1		0	
1	1	0		1		0		0	
1	1	1		0		0		1	