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### CSCI-3080 Discrete Structure
### OLA 1: Chapter 1--Formal Logic
### Name:
### Student ID:
### Date:
### Total points: 100
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Please use formal logic to finish the following 4 exercises. (Total: 100 points) ¶

Exercise 1: Please find the negation of each statement (30 points)

(1) The processor is fast but the printer is slow. (10 points)
(2) If the processor is fast, then the printer is slow. (10 points)
(3) Either the processor is fast and the printer is slow, or else the file is damaged. (10 points)

Please follow the following three steps:
1. First translate the English words into wffs using the formal symbols.
2. Negate the wffs.
3. Translate the negated wffs back into English words.

Note: (2) relies on the fact that $A \rightarrow B \leftrightarrow A' \vee B$ (Implication rule).
so $(A \rightarrow B)' \leftrightarrow (A' \vee B)'$, $(A \rightarrow B)' \leftrightarrow A \wedge B'$ by De Morgan's law

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Exercise 2: Construct truth tables for the following wffs. Note any tautologies or contradictions (40 points)

(a) $(A \rightarrow B) \leftrightarrow A' \vee B$
(b) $(A \wedge B)' \leftrightarrow A' \vee B'$

(a) Truth table for $(A \rightarrow B) \leftrightarrow A' \vee B$ (16 points)

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

(b) Truth table for (A ∧ B)' ↔ A' ∨ B' (24 points)

A	B	A ∧ B	(A ∧ B)'	A'	B'	A' ∨ B'	(A ∧ B)' ↔ A' ∨ B'
T	T						
T	F						
F	T						
F	F						

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Exercise 3: Use a proof sequence to prove that the following argument is valid. (15 points)

(A → B) ∧ [B → (C → D)] ∧ [A → (B → C)] → (A → D)

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Exercise 4: Write the following argument using propositional wffs, then prove that the argument is valid using a proof sequence. (15 points)

If DeWayne is not tall, then Jayden is not DeWayne's brother. If DeWayne is tall, then Trevor is DeWayne's brother. Therefore, if jayden is DeWayne's brother, then Trevor is DeWayne's brother.

Hint: you can use D,J,T as the statement letters
D: DeWayne is tall.
J: Jayden is DeWayne's brother
T: Trevor is DeWayne's brother

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