

In this test,

“ \neg ” means “not”,

“ \wedge ” means “and”,

“ \vee ” means “or”,

“ \rightarrow ” means “if...then...”,

“ \leftrightarrow ” means “if and only if”,

“ $\forall x$ ” means “for all x”, and

“ $\exists x$ ” means “for some x”.

I. True or False

Please answer each of the following questions by writing **True** or **False**. No explanation is necessary. (20 points; 4 points each)

1. $[(A \vee B) \rightarrow C] \rightarrow [(D \wedge \neg C) \rightarrow (A \rightarrow E)]$ is a tautology.
2. $\exists x(\forall y P y \rightarrow R x)$ is logically equivalent to $\forall y P y \rightarrow \exists x R x$.
3. Suppose A is contingent. If A and B are inconsistent and A and C are inconsistent, then B and C must be inconsistent.
4. $P \wedge R$ logically implies Q if and only if P logically implies $P \rightarrow Q$ and R logically implies $R \rightarrow Q$.
5. A is true unless B is false. So A and B cannot be both true.

II. A politician made the following statement during a TV interview:

“If I am not attending a congressional meeting, I am planning for a better future of our country. And if I am not planning for a better future of our country, I am listening to our people for their opinions.” What’s wrong with his statement? (20 points)

III. Let “Lxy” stand for “x loves y”,

“Hxy” stand for “x hates y” and

“Px” stand for “x is a philosopher”.

Please symbolize the following sentence. (30 points)

Someone who is not a philosopher loves exactly two different philosophers who hate each other.

IV. Please prove the following **valid** argument. (You may use the system on the next page. But virtually all formal proof systems are acceptable; just make your proof as clear as possible). **(30 points)**

$\forall x(Rx \leftrightarrow Qx), \exists x(\neg(Px \leftrightarrow Qx) \leftrightarrow Rx) \therefore \forall x((\exists yRy \wedge \exists yQy) \rightarrow Px) \rightarrow \forall x\neg Rx$