AHRF19 (Test 1)

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Please use a pen, not a pencil. Write your name on your answer booklets now. Thank you.

As you proceed, label each answer in your answer booklets with the appropriate 'Qn'. Please strive to write as legibly as possible. Thank you.

Q1 Here is a list of four given statements in the propositional calculus:

$\neg(p \rightarrow q)$
$\neg\neg\neg p$
$(r \vee s) \rightarrow \neg q$
$r \vee s$

Which of the following options is the best answer to the question "What can be deduced from these givens?"? And, secondly, show by a rigorous justification that your selected option is in fact the best one from the five given here.

(a) $\neg u$
(b) $\neg p$
(c) p
(d) h
(e) all of the above

Q2 Assume that p is some declarative statement. Can something be deduced from p by one or more of the inference rules for the propositional calculus in our slides? Answer Yes or No. If Yes, supply five examples of different statements that can be deduced from p.

Q3 In order to make it to RPI (congratulations, by the way!), you had to study math for many years, starting in Kindergarten (or at least First Grade). Along the way, you learned some algebra, including, presumably, The Fundamental Theorem of Algebra (FTA). Jill declares to her math teacher in high school that the probability that FTA holds is equal to the probability that (in base 10) 2+2=4. Teacher Tony replies that Jill's position is irrational, because FTA is much more complex than 2+2=4. Who's right? Why, exactly?

Q4 Sherlock has three perfectly trustworthy clues to work with in an attempt to place four people. The clues are:

(a) It's not the case that: Jill is in Westchester if and only if Chris is in Seattle.

(b) It's not the case that: Henry is not in Seattle or Kate is in Ireland.

(c) Chris is in Seattle or Chris is in Seattle.

Answer the following fill-ins for Sherlock, where what is supplied is either a place-name (where if X is a place-name, we also — rather charitably! — count 'not X' as a place name) or 'UNKNOWN.'

Jill's location:
Kate's location:
Henry's location:
Chris's location:

Justify each of these four answers with a separate proof that employs one or more rules of deductive inference from our list of them for the propositional calculus in our slides, or that employs a new rule of deductive inference that you introduce. If you make use of a new rule of deductive inference, show that that rule is in fact valid before using it. So that your proof is more perspicuous, make use of abbreviations (e.g., 'J_W' for 'Jill is in Westchester'). You are of course free to invent the abbreviations you find most natural, but make sure you explain those you decide to use.

Q5 If one of the following three assertions is true, then so are the other two.

1. There is a smart giraffe in the zoo if and only if there is a male horse in the zoo.
2. There is a smart giraffe in the zoo.
3. There is a lazy llama in the zoo.

Given the above information, which animal among the three is most likely to be in the zoo (if in fact one is most likely)?

Prove that you're right.

Q6 Elmer declares to atheist Triya that Triya is irrational, because God can be proved to exist, and indeed easily at that, using only the propositional calculus. "Oh really?" Triya replies, "then show me!" Elmer then responds by proceeding thus: "Since by definition the doctrine of atheism, if true, entails that God doesn't exist, it's obviously false that, if God exists then atheism holds." Elmer then writes this down on a piece of paper as the following, using obvious abbreviations in the propositional calculus:

$$\neg(G \rightarrow A) \quad (1)$$

Then Elmer continues: "Now, I know you know that if a conditional in the propositional calculus is false, it follows that the antecedent holds, while the consequent doesn't. Hence we can immediately deduce from (1) that G, that is that God exists. Done."

Assuming Triya is presently rational and has understood Elmer's reasoning, should Triya believe that God exists now on the basis of this reasoning? Justify your answer.

Q7 Assume the exact same context for the Wason Selection Task as S Bringsjord has repeatedly given and explained in class (including that the purported rule is the same), but where the four cards presented to you are as follows.

Which card or cards, if any, should you flip over in this permutation? Justify your answer, as rigorously as possible.

Q8 Suppose that you are presented with a version of the Wason Selection Task exactly the same as the one we considered in class, except for two things: viz., (i) the four cards in front of you have the appearance of what immediately follows the present paragraph; and (ii) the rule from in class is supplanted with this new one: "If there's either a vowel or a consonant on one side, then there is a prime number on the other." Which card or cards should you flip over, if any, to do your best to determine whether the rule is true? (A) Pick an option, and then (B) justify, as rigorously as possible, your selection.

a You should flip J only.
b You should flip U and J.
c You should flip U and J and 6.
d You should flip all of the cards.
e You should flip none of the cards.

Q9 Consider the following argument:

All peanut-eating animals are small.
No elephants are small.
Therefore:
No elephants are peanut-eating animals.

Does the conclusion of this argument logically follow from the two premises? Justify your answer.

Q10 The following four statements are either all false, or all true.

(a) If Alvin is happy, so is Betty.
(b) If Betty is happy, Charlie is too.
(c) If Charlie is happy, Darla is happy as well.

(d) Alvin is happy.

Does it follow deductively from the above information that Darla is happy? Prove that you're right, by making use (at least in part) of the propositional calculus.

Q11 Think about the wise-man puzzle. Let Roger and Sam be wise men in a puzzle of that variety. Suppose that Roger and Sam know some proposition represented in the propositional calculus as q. Suppose as well that $\{q\} \vdash_{\text{PC}} r$. Does it follow that Roger knows that Sam knows r? Does it follow that r? Justify your answers.

Q12 Recall our definition of the Monty Hall Problem (MHP) in class. Let's consider a variant of standard MHP that has not three doors, but 47 (MHP_{47}). Full Monty in this variant reveals what's behind one of the 46 doors not initially picked, everything else remaining constant from the original MHP. Is switching still a rational policy in this variant? Justify your answer with reference to the odds of winning on the HOLD policy versus the SWITCH policy for the MHP_{47} game.

Q13 Recall the auction for \$60 dollars we held in class. Is it rational to enter an auction of this type? Justify your answer. (No more than one page in booklet.)