Critical Thinking Exercises from Lecture 3

1. State the necessary and sufficient conditions for the conditional claim in these arguments. What is the form of each of the arguments? Is this a valid form or an invalid form?

a) A robot doesn't have DNA, and since all things which are alive have DNA, it can't be alive.

b) If the police do their jobs properly, then the rate of crime does not increase. The crime rate has declined recently, so the police are doing their jobs properly.

c) Only those without a criminal record are members of parliament, and since Scott Morrison is a member of parliament, he doesn't have a criminal conviction.

d) She went to university for four years. To get a degree you must go to university for at least three years, so she has a degree.

e) If the beer's not from Australia, it's not real beer. That's an Australian beer, so it's a real beer.

f) Only if you don't have anything else to do will you watch a James Bond movie. You've got nothing else to do, so you'll watch a James bond movie.

2. Are the following claims true or false? Explain.

a) A valid argument can have a false conclusion.
b) A sound argument can have a false conclusion.
c) An invalid argument can have a true conclusion.
d) A conclusion can be valid.
e) An argument can be true.

3. The following arguments are deductive, but not straightforward conditional arguments. Is each argument valid? State whether or not each premise and the conclusion is true or false. In the argument sound?

a) Either the moon is made of green cheese, or all rivers flow uphill. The moon is not made of green cheese, therefore all rivers flow uphill.

b) If you were born overseas but applied for Australian citizenship, or you were born in Australia, then either you've failed the immigration requirements, or you have at some stage been an Australian, whether or not you now hold citizenship. Kylie Minogue has neither applied for Australian citizenship, nor does she fail the immigration requirements, but she was born in Australia, so she has at some time been an Australian citizen.

c) Every human being has twenty-three pairs of chromosomes, therefore since Albert Einstein is a human, he had twenty-three pairs of chromosomes.

d) Madeleine is older than Skye, and Skye is younger than Lily. Therefore, Madeleine is older that Lily.

Answers:

1.

a) The necessary condition is "it has DNA".
The sufficient condition is "it is alive".
Denying the necessary condition – valid.

b) The necessary condition is "the rate of crime is not increasing".
The sufficient condition is "the police are doing their jobs properly".
Affirming the necessary condition – invalid.

According to the first premise, police doing their jobs properly will reduce crime, but that premise does not say that this is the only way to decrease crime.

c) The necessary condition is "not having a criminal record".
The sufficient condition is "being a member of parliament".
Affirming the sufficient condition – valid.

d) The necessary condition is "going to university for at least three years".
The sufficient condition is "having a degree".
Affirming the necessary condition – invalid.

According to the first premise, going to university for at least three years is necessary for getting a degree, but that premise does not say that it is the only requirement for getting a degree - e.g. you must also pass a sufficient number of courses.

e) The necessary condition is "not being real beer".
The sufficient condition is "the beer not being from Australia".
Denying the sufficient condition – invalid.

It might be true that only Australian beers are real beers, but this does not mean *all* Australian beers are real beers.

f) The necessary condition is "you do not have anything else to do".
The sufficient condition is "You will watch a James Bond movie".
Affirming the necessary condition – invalid.

According to the first premise, you need to have nothing else to do to watch a Bond movie, but you do not *have to* watch a Bond movie if you've got nothing else to do.

2.

a) True. If a valid argument has a false conclusion then it must be the case that at least one of its premises is also false.

b) False. If a conditional deductive argument is sound, then it has truth-preserving form (i.e. it is valid) and has only true premises. In this case, the conclusion has to be true.

c) True. An invalid argument has bad form, but it need not have false content in its premises or in its conclusion.

d) False. A conclusion is a claim which can be true or false. Validity is a potential property of arguments, not a potential property of claims.

e) False. An argument can be valid or invalid, sound or unsound, but an argument cannot be true or false.

3

a) This is a valid disjunctive argument. The first premises says that either *A* ("the moon is made of green cheese") is true, or *B* ("all rivers flow uphill") is true. The second premise says that *A* is *not* true. The conclusion is that *B* must be true. If we pretend that the premises are true, we can see that this conclusion follows necessarily from the premises.

   The first premise is false, because these two disjuncts are both in fact false. The second premise is true, the moon is *not* made of green cheese. And the conclusion is false, all rivers do *not* flow uphill.

   As for soundness, even though the first condition for soundness is met – the argument is valid – not all the premises are true, so the argument is an unsound, bad argument.

b) The argument is valid. If the premises are true, the conclusion must be true. Here is an explanation of why. The first premise is a big conditional claim with a disjunction as the sufficient condition and a disjunction as the necessary condition ("If *you were born overseas but applied for Australian citizenship, or you were born in Australia*, then *either you've failed the immigration requirements, or you have at some stage been an Australian, whether or not you now hold citizenship*"). We can represent this as If (p v. q) then (r v. s) where

   p = *you were born overseas but applied for Australian citizenship*

   q = *you were born in Australia*

   r = *you've failed the immigration requirements*

   s = *you have at some stage been an Australian, whether or not you now hold citizenship*

   The sufficient condition contains two options, p or q. We are then told that p is false but that q is true. Therefore, the entire disjunctive claim which forms the sufficient condition (p or q) is true. So if the conditional claim is true, and if the sufficient condition is true, then the necessary condition (r or s) is also true. But we have been told in another premise that r is false. If (r or s) is true but r is false, then it must be the case that s is true. And s is in fact the conclusion of the argument as presented. So, this argument is valid.

   The argument has the form:

1. If (p or q) then (r or s)

2. Not p

3. q

4. Not r

Therefore, s

As for the truth of the premises, the first premise seems to be false. Someone could have applied for Australian citizenship and neither failed nor succeeded in becoming a citizen because their application is in the process of being considered. The argument is valid, and has a true conclusion, but it is not sound because it does not have only true premises. (This question is more difficult than anything that I will set you in your test or exam.)

c) This argument is valid. It affirms the sufficient condition. If every human has 23 chromosomes, then when we pick a particular human, they must have 23 chromosomes. If the premises are true, the conclusion must follow.

The first premise is, however, false. Many humans have genetic conditions, for example Down's Syndrome, where they have more or less chromosomes. The second premise is true – Einstein is a human, and the conclusion is probably true – it hasn't been reported that Einstein had more or less chromosomes.

The argument is therefore unsound. Although the inference is valid, not all the premises are true, and the argument therefore doesn't give us any reason to believe the conclusion.

d) This argument is invalid. Here is one possible scenario in which the premises are true but the conclusion is false: Madeleine is 30, Skye is 19, and Lily is 40. Since it is invalid, it is also not sound, regardless of the fact that we do not know the actual ages of these people.