

Ibn Sīnā on conditionals,
Qiyās 5.1

Wilfrid Hodges

18 August 2010

1 The section being translated

This section is Ibn Sīnā's main introduction to 'If ... then' sentences. Apart from the section on counterfactual inferences at the end, it contains very little logic. From Ibn Sīnā's point of view, 'If ... then' sentences are a kind of object in the world, and we can describe and classify them just as we describe and classify precious minerals or types of insect. The closest modern parallels are probably in the discussions of conditionals that one finds in the borderlands between linguistics and cognitive science.

The section on counterfactuals may contain some things of interest. Ibn Sīnā's main point is that if you are reasoning from a premise that you know to be false, there are some dos and don'ts about what other premises you can or should use. What he says would be very damaging to mathematical uses of *reductio ad absurdum*, for example. Elsewhere he gives a very different account of *reductio ad absurdum*, but so far I haven't found any place where he reconciles the two positions.

This translation is very definitely work in progress. In particular it hasn't been checked by a native Arabic speaker. I had the advantage that there is already a published translation in Nabil Shehaby, *The Propositional Logic of Avicenna: A Translation from al-Shifā': Al-Qiyās with Introduction, Commentary and Glossary*, Reidel, Dordrecht 1973, which was helpful for avoiding serious misunderstandings. But the translation below is new and doesn't always agree with Shehaby.

Here are some correlations of technical terms:

declarative: *jāzim*; Shehaby 'statement-making'.

difference-like : *munfaṣil*; Shehaby 'separative'.

goal: *maṭlūb*; Shehaby 'quaesitum'.

meet-like: *muttaṣil*; Shehaby 'continuous'.

predicative: *ḥamlī*; Shehaby 'predicative'.

premise: *muqaddama*; Shehaby 'premiss'.

propositional compound: *ṣarṭī*; Shehaby 'conditional'.

Shehaby's terms often have historical justification. For example the word that Shehaby translates as 'continuous' is almost certainly an Arabic rendering of the Greek *sunekhēs*, which is standardly translated as 'continuous'.

Shehaby's book also contains a commentary on the passage, with a good deal of historical information. But I am doubtful about several points of Shehaby's interpretation of Ibn Sīnā; for example I see no evidence for the truth-functional account of 'If . . . then' sentences that Shehaby ascribes to Ibn Sīnā.

I need to fix words for entailment. Perhaps *ittibāc* = following from, and *luzūm* = being a consequence of. Do we need 'entailment'? At 234.3 *luzūm* includes lightning being a consequence of movement in the clouds.

2 'If five was even'

Ibn Sīnā discusses the following sentences:

- (1) If five was even, five would be a number.
- (2) Every even thing is a number.
- (3) Five is even.
- (4) Five is a number.
- (5) Not every even thing is a number.
- (6) No number is both five and even.
- (7) Nothing which is five and even is a number.
- (8) Whatever is five and even is a number.
- (9) Some number is five and even.

His first point is that (2) can be taken to be true, because of the entailment

- (10) (2), (3) ⊢ (4).

The first premise is suppressed background knowledge.

His second point is that with counterfactual conditionals it may be inappropriate to use certain background facts as premises. He might have given as an example the negation of the counterfactual assumption itself. But in fact his example is that if (3) is assumed counterfactually, we are not entitled to assume (2); in fact we should commit ourselves to (5), which is the contradictory negation of (2). His argument to this conclusion is that if (2) and (3) are assumed, we can deduce from them the negation of a known fact p . But this hardly makes his case, since one could answer that if any background information is to be discarded when (3) is assumed,, it should be p rather than (2). He shows no awareness of this point.

In more detail, his argument runs as follows. He states (6) as a fact. From this he deduces (7). He offers no principle for this; presumably the principle would be

- (11) From 'No A is a B and a C ' deduce 'Nothing that is a B and a C is an A '.

This is a sound deduction but not syllogistic. Does it occur elsewhere in Ibn Sīnā?

Then from (7) and the assumption (3) Ibn Sīnā deduces (5). The form of the argument is

- (12) From 'Every A is a B ' and 'Nothing that is an A and a B is a C ' deduce 'Not every B is a C '.

This is a sound inference, given that the first premise is affirmative and hence implies that something is an A . But again it is not syllogistic.

His third point is as follows. Suppose the counterfactual claim (1) was true. Then we can deduce the indicative statement (8). Strictly a further premise is needed for this, namely that there is something that is five and even. But the premise (1) implies that five is such a thing, though this is not a syllogistic implication. Now Ibn Sīnā notes that (8) is not in fact true. The real reason is that nothing is five and even, but Ibn Sīnā tries to put the point in terms of inferences rather than semantics. From (8) he deduces (9) by conversion. Now (9) is simply false. From Ibn Sīnā's own arguments it should follow that (1) is false too, but Ibn Sīnā doesn't draw this conclusion. In fact he has already denied it, when he said (1) is true.

Ibn Sīnā makes one further observation, namely that if (8) is false, then so is the corresponding conditional. But what is the corresponding conditional? Elsewhere he seems to deny that there is one; and in this instance he makes no further use of the remark. See the Notes.

3 Translation of *Qiyās* v.1

Book V

V.1 On propositional compounds and their classification 231.5

[5.1.1] Some premises are predicative and some are propositional compounds. Likewise some goals are predicative and some are propositional compounds. Also some predicative propositions are reckoned to be true without the aid of a syllogism, while others need a syllogism [to show their truth]; and the same holds for propositional compounds. Many of the claims made in mathematics, physics or metaphysics are propositional compounds, either meet-like or difference-like. 231.6

[5.1.2] Predicative propositions can be proved by syllogisms with predicative premises or by syllogisms whose premises are propositional compounds. But propositional compounds are not entailed by predicative premises, as you know. It follows that there are propositional compounds forming syllogisms that entail a propositional compound, either on their own or combined with some other kind of proposition, as we will show. 231.9

A propositional compound is like a predicative proposition in that each of them is a declarative sentence which is posited [or denied] because it is reckoned true or false. Also [both kinds of proposition] can be conceptualised in two different senses: we conceptualise their meaning, and besides that we conceptualise their relation to the external [world], namely whether they correspond [to the external world]. Thus every proposition is conceptualised /232/ in isolation in the first place, but then we assent to it only when its relation to the external [world] is one of correspondence. On the other hand, propositional compounds differ from predicative propositions in the following way. A propositional compound is necessarily a compound of parts in such a way that the composition carries a piece of information. But at the same time the relation between the parts is not a relation that consists — in the affirmative case — of saying that the first part ‘is’ the second part, as in the sentence 231.10

(13) The human is a writer.

in the sense that one puts the first of the two items, then ‘is’, then the second. So it shares with the predicative proposition the property that the 232.5

content lies in the relation of one part to another, but the propositions differ in the form of that content. In fact propositional compounds also differ from each other in this relation. Some have an affirmative relation of the form that one part follows from the other, while others have a negative relation of the form that the two parts conflict with each other. (We are taking both propositions to be affirmative.) Thus in the proposition

(14) If the sun is up then it's daytime.

the coupling is affirmative, by way of following, whereas in the proposition

(15) Either it's like X or it's like Y.

it is by way of conflict.

232.10

[5.1.3] Let's make a start on examining what people say about meet and conflict. They say: Some meets are complete and some are not complete. And likewise some conflicts are complete and some are not complete. They count as a complete meet the case where the first clause is a consequence of the second clause, just as the second was a consequence of the first — as if one said

232.11

(16) Whenever the sun is up, it's daytime, and whenever it's daytime the sun is up.

An incomplete meet is the case where the second clause follows from the first clause and not conversely, as if you said:

232.15

(17) Whenever [it's the case that] this is human, it is an animal.

And it doesn't convert, since it is not the case that

(18) [In cases] when that thing is an animal it's human.

And they say too that some conflict is deficient and some is complete. Complete conflict is when not only are the two parts in conflict with each other, but the contradictory negation of each part /233/ is exactly equivalent to the other part, as when we say:

(19) Every number is either even or odd.

Defective conflict is when a conflict arises but the contradictory negation of one of the two parts is not the exact equivalent of the other part, as when we say:

(20) Six is either a perfect number or an abundant number.

without further comment. In fact it's not true that a [number] that is not abundant is perfect; it could be deficient.

[5.1.4] One person said that meet-like corresponds to affirmation and difference-like to negation. Other people said that in general a propositional compound is neither an affirmation nor a denial. Also [they say that] the difference-like propositions could include propositions such as 233.4
233.5

(21) Zayd is either not a plant or not an animal.

and

(22) Zayd either is not a writer or is moving his hand.

These people also have propositions which are used as propositional compounds but are ambivalent in their features; we will mention them later.

[5.1.5] One person thought that a meet-like propositional compound is a 'conditional' only through its first clause having an element of doubt in it. And one of them thought that the sentence 233.10

(23) Whenever this is human, this is an animal.

and sentences like it are predicative and not meet-like, as if one said

(24) Every human is an animal.

[5.1.6a] We should start by considering the consequence [relation] in meet-like [sentences]. You might say that the consequence [relation] can consist in the following: the first clause is posited and forms the relatum, indicated by having attached to it a conditional particle of the first kind; it requires an answer, namely the consequent, and it requires for its essence that the second clause follows it. This [description] is self-evident. For example when one says 233.12
233.15

(25) If the sun is up, then it's daytime.

then the posit is 'The sun is up', and [the proposition claims that] a consequence of this [posit], both in the world and in the intellect, is that it's daytime. In some cases this [first clause] has the consequence in the sense that it causes the second clause to be true, just as /234/ in this example. In some cases it is an inseparable effect, as if we said:

(26) If it's daytime then the sun is up.

Sometimes it is a relational correlate. Sometimes it is that each of the two is an effect of the cause of the other, so that the two are effects of a single thing which they are both consequences of together: like thunder and lightning [both caused by] movement of wind in the clouds. And sometimes there are other aspects that needn't be mentioned here.

[5.1.6b] The point here is that in some of these cases the positing of the first clause had the second clause as a consequence, not as something that the intellect grasps intuitively, but rather in the facts of the case, so that it's a fact that whenever the first clause is validated, the second clause is [validated] too, because of a connection between the two, in the presence of which the first clause can't be validated without the second clause being validated too — either because the first clause is necessitated by the second, or else the first necessitates the second, or else because both are necessitated by a single cause, or else the two are correlates, or maybe for some other reason like that. 234.5

[5.1.7] The relation of following [between first and second clause] can take a different form. Namely, when the premise is true, then the consequent is true too, but in this case there is no observable link at all that can be expressed in terms of [the contents of] the two clauses — even if for example the connection is necessary because of actual facts that one is not aware of either intuitively or scientifically. Thus we might say: 234.10

(27) If humans exist then horses exist too.

not judging that this following is necessary in the facts themselves, nor that the existence of humans in itself compels or prevents the existence of horses; but just that we allow it as a possibility that it happens to be so, even if it doesn't happen to be so, and even if there is nothing like that in the facts of nature. The general propositional compound has to include all these cases. 234.15

[5.1.8] Suppose one takes 'meet-like propositional compound' to mean a meet-like 'conditional' proposition that consists of a condition and a consequent. Then the 'strict conditional' sentence is the case where the second clause follows from the first as /235/ a consequence of positing the first clause. There is nothing for us to concern ourselves with here. Rather than that, we should discuss the special features of each of the two. There are conditional particles which occur in meet-like propositional compounds and signify consequence as we have described it, but there are other par- 234.18

cles that don't signify this. One that does signify it is the expression 'if'. Thus you wouldn't say

(28) If the resurrection took place, then humanity would be called to account.

because you don't see the second clause as a consequence of the positing of the first clause. That is because the second clause expresses something that is not necessary but subject to the will of Allah the Highest. You would say: 235.5

(29) When the resurrection takes place, humanity will be called to account.

Likewise you wouldn't say:

(30) If humans exist, then two is even.

or

(31) If humans exist, then no vacuum exists.

But you would say:

(32) At a time when humans exist, two is even too.

and

(33) At a time when humans exist, it's also the case that no vacuum exists.

The effect is that the expression 'if' strongly signifies consequence, whereas 'at a time when' does so weakly. [The expression] 'when' is intermediate, and the expression

(34) Since it holds that p , it holds that q .

doesn't signify consequence at all. Likewise the expression 'whenever' doesn't signify consequence. The expression 'so long as', when you say 235.10

(35) So long as p holds, q holds.

can legitimately be taken either way; it doesn't compel one of the two readings.

[5.1.9] The first clause in a meet-like propositional compound signifies only that the first clause is posited, not that the posited first clause is true or that it is not true. So when we say

(36) If p then q .

this ' p ' doesn't mean that it's the case that p , as if the meaning [of the whole sentence] was that ' p ' means that it is the case that p , and so long as this is so, ' q ' means that it is the case that q . That would make the first clause true on its own, and the second clause true on its own, though they are both spoken together. It would also make the first clause /236/ a complete utterance — if the speaker was silent after it. But again this is not what the first clause signifies; what the first clause signifies is that the truth of the second clause follows from its (i.e. the first clause's) truth. In fact the first clause is a pseudo-proposition. The content [of the whole sentence] is that the truth of the second clause follows from the truth of the first clause. The [first clause] doesn't contain a condition at all. Rather, the condition [expressed by the whole sentence] transforms the parts from being propositions. Thus when you say

(37) If p

then what you say is neither true nor false. And when you say

(38) Then q .

what you say is neither true nor false, since the 'then' gets its justification from signifying the [relation of] following. Unless of course we are speaking a language which has no way of marking the second clause as being the second clause, apart from the fact that it follows [the first clause]. In this case the second clause on its own could be true or false, because one could read it in a way that leaves out part of its intended meaning. But if it is read in a way that gives it all of its real meaning [in context], then it is as it would be if 'then' was attached to it. When 'then' is attached to it, it is like when you say:

(39) Then in this case q .

or

(40) In spite of that, q .

These are neither true nor false until it is known what was posited. The phrase

(41) *Z is H.*

even though it is true or false in itself, when it is considered as a first clause, it is no longer a thing to be doubted or assented to. Considering it as a first clause, what one takes into account is just whether the second clause is or is not a consequence of it. Sometimes there is no doubt that [the first clause] is false, as in the sentence:

(42) If ten is odd then it has no half.

But sometimes it is posited precisely because its truth has been confirmed, 236.15
in order to justify the second clause. The propositional compound in itself
doesn't assert either its first clause or its second clause. Neither the first
nor the second clause is there to serve as a thing that is reckoned to be true.
Since they are not there for that purpose, doubting them is irrelevant.

[5.1.10] But as a matter of [the application of] the pair of clauses rather 236.19
than their internal form, sometimes one doubts the second clause when the
aim is to derive it, or the first clause when the aim is to refute it. /237/

[5.1.11] So we say: A phrase which signifies that for some thing X, an-
other thing Y is true 'with it', in the sense that whenever the first [of the
two] is true the second is true too, is a phrase which is a proposition, but
definitely not a predicative one. So it definitely has to be a propositional
compound, of the sort called meet-like. If the condition and the consequent
are strict, then the positing of the first clause has to entail that the second 237.5
clause is true, in view of some link between the two. This link could be a
relation of various kinds, such as a relation of predication or an explicit re-
lation of strict correlation, or a relation of inherent correlation because one
of the two is a cause or effect [of the other], or [they are] whole and part,
or [the first is] universally quantified and [the second is the corresponding]
existentially quantified proposition; or anything along these lines from the
inherent correlations that you know about where the inherent is not con-
stitutive for its substance. The link could be known to us, or it could be
unknown so that we need to find out about it. The first [kind of conse-
quence] also includes those that in one way or another reduce to the kind
above, so that what determines the actual truth [of the proposition] is some 237.10
link [between first and second clause]. On the other hand [there are cases]

where the mind already knows the truth of the second clause, so that it doesn't move there from the positing of the first clause, either by a primary movement of thought or by a reasoned one. Then the positing of the first clause will be useless for moving the mind from it and to the second clause. So let us take the meet-like [propositional compound] to be either absolute, where the claim made in it is that the second clause is true whenever the first is, or else the strict case, where the truth of the second clause is implied by the first clause. The first of these two cases includes the second, since it can be subdivided into those [expressing that] the consequence is an implication, and those [expressing that] it happens to be the case that [the second clause] is true whenever [the first] is. 237.15

[5.1.12] But there are some points that cause doubts about this way of construing [meet-like propositional compounds.] For example, when /238/ one impossibility is posited so that another impossibility follows explicitly from it, as when we say: 237.16

(43) If the human weren't an animal, it wouldn't have perceptions.

should this sentence be accepted or not? If the condition bringing the clauses together is not entailment, this sentence shouldn't be accepted. Someone might well say:

(44) If we assume the truth of "The human is not an animal", the statement "It doesn't have perceptions" doesn't have to be true in association with it, when there is nothing to entail this association. [For the non-strict kind] the requirement is that [the posit] is an assumed content and that something should happen to be true whenever it is, without any regard to implication. But the statement that the human has no perceptions is not true; so how could it come to be true along with something else that is merely an assumption, unless this connection is enforced by entailment? If the second clause is not true in itself, and becomes true only when the first clause is, then it's implied by the first clause.

The [right] response to this is that if q is true whenever p is, this includes the case where the truth of p entails the truth of q . Thus when it's entailed that q is true whenever p is, then certainly q is true whenever p is. So it's not the case that if q is true whenever p is, then this has to happen without there being an entailment. In fact it does sometimes happen without an entailment, and sometimes with one. In the present case there is nothing 238.10

to make the second clause true whenever the first clause is, unless it be entailment. In fact the first of the two clauses is assumed true, the second couldn't be true whenever the first is unless it was entailed. This is because it's impossible for the two clauses to be both true together. [A conditional] is true without entailment just so long as when its first clause is true, that doesn't prevent its being associated with the truth of the second clause; this is because one truth doesn't prevent another. When [the first clause in such a conditional] is false, in some cases this prevents [the truth of the second], but in some cases it /239/ doesn't. 238.15

[5.1.13] Suppose one says:

- (45) When humans caw, crows talk.
OR: If humans cawed, then crows would talk.

Neither way of saying it can be true. [The first] is not true as a result of the second clause being true in itself whenever the first clause is — in fact both of them are false. — And [the second] is not true as a result of one of the clauses being entailed by the other. 239.1

[5.1.14] Suppose one says 239.3

- (46) If humans exist, then no vacuum exists.
OR: If humans existed then no vacuum would exist.

The first reading is true but the second is false. Thus, the truth of the latter clause whenever the first is true is not a consequence of [the first clause] being posited. Even though [the second clause] is true whenever the other is, entailment is a part of [what] the second clause [expresses] in strict [propositional compounds], but not a part of [what] the second clause [expresses] in absolute propositional compounds. But the expression "therefore" was posited to express this. There are other expressions [that do a similar job]; you learned all about these when they were explained to you earlier. 239.5

[5.1.15] Know that the statement 239.9

- (47) If five was even then it would be a number.
OR: If five is even then it is a number.

is true on the one reading but not on the other. The sentence is true when the speaker is reporting an entailment. But as a statement about the facts themselves it is not true, even though it is undoubtedly necessary in itself 239.10

that the first clause entails the second. And that is because what is undoubtedly true for this proposition is the statement:

(48) If five is even then it is a number.

In cases like this, [the consequence] is a syllogism which makes [the conclusion] follow and makes it necessary. But the syllogism has suppressed a premise. The analysis of the syllogism is that when it has been posited that it is true that

(49) Five is even.

and it is true in itself that

(50) Every even thing is a number.

then the person [making the syllogism] claims that it's a consequence of all this that five is a number. But the reason for this is that the person has made a commitment that is partly false and partly true. A person who commits himself to the false [part] doesn't also have to commit himself to the true [part]. In fact when it is posited that five is even, then one doesn't have to commit oneself to the proposition that every /240/ even thing is a number. Given the first commitment, it is not safe to make the second; one ought not to make the second commitment. If it is posited that five is even, then the fact of the matter is that the latter commitment should not be made. There is nothing wrong with having an impossibility following from from an impossibility, but the effect is that when one commits oneself to a falsehood, it would be better not to infer that one should commit oneself to something that is true. Rather, when one is committed to something impossible, then one will have to commit oneself to another impossibility along with it if the second impossibility is entailed by the first. The fact of the matter is that when you have committed yourself to the proposition that five is even, you will necessarily have to commit yourself to the proposition that not every even thing is a number. An indication of this is as follows. When one has committed oneself to (49), it follows that one is committed to the proposition that

(51) No number is five and even.

And that implies that

(52) Nothing that is five and even is a number.

So when one is committed to the proposition that five is even, then [given that] this five is not a number, we have

(53) Not every even thing is a number.

But the person who made the posit has to make it follow [that five is a number] — because he took a false posit and a thing which is true in itself, and combined the two things, so that something followed from it which wouldn't have followed if he hadn't committed himself to that truth; he didn't have to commit himself to it when he had committed himself to a falsehood. Even if one must deny the false first statement [(that five is even)] and accept a commitment to the true second one [(that five is a number)] when one is considering what is true, it's obligatory, or [at least] permissible, to deny the truth in both cases when one is riding on the back of a falsehood. 240.10

[5.1.16] If the statement 240.13

(54) If five was even then it would be a number.

were a truth that one had to be committed to for its own sake, then it would be true to say

(55) Everything that is five and even is a number.

Now if (55) is false, the meet-like [propositional compound] which is equivalent to it is also false. But if the predicative sentence [(55)] was true, then its converse, namely 240.15

(56) Some number is five and even.

would be true.

[5.1.17] So you now know the facts about the strict meet-like proposition which expresses entailment, and the case where its first clause on its own is false, and the case where both the second and the first clause together are false, and where the first clause couldn't possibly be true, and when [the proposition] is false from some particular aspect, /241/ and that falsehoods don't follow from truths. False propositions can be made from two true ones, for example 240.17

(57) Whenever the human stands still, the human moves.

where each of the two propositions is true as a two-sorted statement. And likewise when you say:

(58) It is always false that if the human is an animal then he is a body.

And in fact this [proposition] is false, though both clauses are necessary truths.

4 Notes on *Qiyās* 5.1

[5.1.2]

232.1 ‘assent’ (*taṣḍīq*): This seems to be a quite different condition for *tasdiq* from that usually given in IS. Also it’s unusual (perhaps unique here) that Ibn Sīnā considers assent as a form of conceptualisation (*taṣawwūr*).

232.2 ‘necessarily’ (*biḍ-ḍarūra*): This is stronger than saying it ‘has to be’ a compound. The extra emphasis is unexplained; perhaps it’s a quirk of style.

232.4 ‘The human is a writer’: Ibn Sīnā uses a common Arabic sentence form that has no word to express ‘is’. But then in the explanation he uses a word that expresses ‘is’ (in fact a pronoun and not a verb, but this is irrelevant to the point).

232.6 Ibn Sīnā fails to distinguish clearly between two classifications of propositional compounds. Suppose a propositional compound has first clause ϕ and second clause ψ . The first classification is in terms of how ϕ relates to ψ , independent of any facts about this propositional compound. The second is in terms of how ϕ would have to relate to ψ in order for the compound to be true; or in a slight variation, what we are believing about ϕ and ψ when we assent to the compound. In the first kind of classification, we could pick out those compounds where the second clause follows from the first (regardless of whether the compound proposition expresses this). In the second we could pick out those which express that the second clause follows from the first (whether or not it does in fact follow).

There is a corresponding difference between two ways of classifying predicative propositions. The first kind of classification

corresponds to the matter of the sentences, the second corresponds to the classification by logical form. In the case of predicative propositions, Ibn Sīnā is absolutely clear about the difference between the classifications, though sometimes (as for example in the *Iṣārāt*, frankly a badly written book REF) he sometimes uses language that suggests he is talking about the matter when in fact he is talking about the form.

In the present section, Ibn Sīnā consistently uses language that, taken literally, suggests the first sort of classification. Most modern logicians would assume that, since this is a textbook of logic, he means the second sort of classification and is expressing himself very carelessly. But at least in the *Qiyās*, Ibn Sīnā is normally not a careless writer, and so I suspect there has to be a deeper explanation.

I suspect the right explanation is along the following lines. Ibn Sīnā always has his mind on what he considers the main task of logic, namely to assess arguments. He assumes we have in front of us an argument proposed either by ourselves or by somebody else. The first task in assessing an argument is to work out what the proposer meant by the sentences involved. There can be no general method for this. The second task is to find sentences that correctly express what we think the proposer meant; Ibn Sīnā says a good deal about this, but it is not his topic here. The third task will normally be to assess whether the premises are true, and to reject the argument if they are not. Only at the fourth stage do we start to analyse what follows from the premises, and at this stage the premises can be presumed true. So if they assert a relationship between their parts, then that relationship holds; and conversely, if the relationship holds and is relevant to the argument, we should have chosen sentences that assert it.

Today, global formalising makes this approach unacceptable.

[5.1.3]

232.11 ‘meet’ (*ittiṣāl*): Ibn Sīnā should have defined this here. He did give a definition of a sort at *‘Ibāra* 32.10 and 42.10.

232.13 ‘as if’ (*ka*): What Ibn Sīnā says here could easily mislead. The Arabic could be read as saying that (16) is an example of a propositional compound where the second part is a consequence of

the first and vice versa. But the first part of (16) is ‘Whenever the sun is up, it’s daytime’ and the second is ‘Whenever it’s daytime the sun is up’. Neither of these parts is a consequence of the other. Ibn Sīnā presumably means that there is a reading of (14) that makes it express the same as (16); an example of Ibn Sīnā explaining the meaning of a sentence by adding extra material to the sentence. This reading of (14) is the example of a perfect meet.

232.16 ‘the case’: Ibn Sīnā certainly didn’t think it makes sense to talk of a thing being human (or an animal) at some times during its existence and not at others. So when he uses temporal conjunctions, either he has in mind that ‘this’ and ‘that’ come into existence and then cease to exist, or he imagines we are examining cases. The translation follows the second interpretation.

233.1 ‘either even or odd’: This sentence is not a propositional compound! It’s hard to see how this can be anything other than a mistake on Ibn Sīnā’s part. The example can be rescued by changing it to ‘Either this number is even or this number is odd’.

233.3 ‘either ... or’: Again this is not a propositional compound. But at least this time it is synonymous with a propositional compound, ‘Either six is a perfect number or six is an abundant number’.

The reference is to a classification of positive integers that goes back to ***. Suppose n is a positive integer, and let m be the sum of all the integers between 1 and $n - 1$ inclusive that divide n . If $m = n$ we say that n is *perfect*; examples are 6 and 28. If $m > n$ we say that n is *abundant*, and if $m < n$ we say that n is *deficient*.

[5.1.4]

233.5 ‘meet-like corresponds ... negation’: This appears to be Ibn Sīnā’s own view in the sense that meet-like corresponds to compatibility of subject and predicate, and difference-like to incompatibility. REF

233.8 ‘ambivalent’ (*mutaraddad*): These will be defined at 257.10. They are propositional compounds where both clauses have the same subject, so it can be extracted to topic position, making the sentence look predicative.

[5.1.5]

- 233.10 ‘conditional’: Here we run into the problem that *šartī*, which Ibn Sīnā uses for propositional compounds in general, literally means ‘conditional’. See REF.
- 233.11 This view, that sentences of the form ‘Every *A* is a *B*’ can be paraphrased as conditionals with the same pronoun in subject place in both clauses, appears everywhere in Boethius’ *De hypotheticis syllogismis*. Ibn Sīnā didn’t know Boethius’ writings, but nobody supposes that Boethius thought up the idea himself. Boethius’ source is not known, but could have been a Greek writer in the circle of Porphyry; in which case it could be Ibn Sīnā’s source too.

[5.1.6a]

- 233.12 ‘We should start’: This is clearly the beginning of a new section, though the Cairo edition has it in the middle of a paragraph. Do the manuscripts make it a new section? Or are the paragraphs the work of the Cairo editor?
- 233.13 ‘you might say’ (*taqūlu*): Shehaby emends to ‘we say’ (*naqūlu*), which is plausible but not supported by the mss.
- 233.14 Note Ibn Sīnā’s usual way of describing the meaning of a sentence: he repeats the sentence but with further material attached.
- 233.15 ‘self-evident’: It must be Ibn Sīnā’s account that is self-evident, not the truth of the propositional compound. Ibn Sīnā is confirming the conclusion in the commentary above REF, that the statement in 233.12–15 is a minimal description of meet-like propositional compounds and is not intended to include anything that might be controversial.
- 233.16 Grammatically the straightforward reading is ‘*in wuḍīʿa*. But then the sense is incoherent; so I tentatively read ‘*inna waḍʿa*, which is written exactly the same way. Then the topic of the sentence is ‘the posit “The sun is up”’.
- 234.2 ‘relational correlate’: Probably he means a converse. An example might be that the first clause is ‘*A* is a parent of *B*’ and the second clause is ‘*B* is a child of *A*’.

[5.1.6b]

- 234.3 What follows in [5.1.6b] seems to be a recap of the previous few lines, emphasising the point that the connection between first and second clauses need not be a purely logical one, though it does have to be one of consequence (*luzūm*). It's tempting to guess that 234.7 end to 234.9 are a reader's marginal note that got incorporated. But there is no compelling evidence, so I left the text to stand.
- 234.9 If the two are correlates, then shouldn't the implication be logical and hence grasped by the intellect?

[5.1.7]

- 234.10 The question is how the case described in [5.1.7] differs from that in [5.1.6], and in particular that in [5.1.6b]. There is still a 'following', but *ittibā^c* rather than *luzūm*.
- 234.12 I read *maṭalan* 'for example'. Shehaby's *muṭulan* 'ideas', which is written the same way in Arabic, is foreign to Ibn Sīnā's style and thinking in his logic. In any case the case being described seems to be one in which there might not be any connection at all between antecedent and consequent. (Goodman agrees.)
- 234.13 The example (27) is poorly chosen (at least for a modern reader). Ibn Sīnā's example sentences serve their purpose only if we can see the kind of context in which they are likely to be used, so that we can sense what would be intended by them in context. But it's completely unclear when someone might want to utter or write (27), and hence unclear what meaning it is supposed to be illustrating. That is, unless *tajwīz* in line 234.15 means precisely that the proposition is not intended to be true, but is intended to be possible and hence to serve as a premise or rule from which other possibilities can be deduced.
- 234.17 I take him to mean that the description 'meet-like propositional compound' includes all these cases, not that every meet-like propositional compound allows interpretations of all these kinds.

[5.1.8]

235.1 From this it's not clear what the two cases are. There are three cases just named. First there is the strict conditional. Second there is the conditional, but not strict (because the consequent doesn't follow logically). Third there is the non-conditional meet-like propositional compound, for example conjunction. I hope it comes clear which two Ibn Sīnā has in mind here. Probably kinds one and two.

Also is the negative expression *mā^calaynā* in the grammars?

235.10 The Cairo text has Ibn Sīnā contradicting himself about '*idā*' 'when'. Shehaby follows one manuscript in reading the second '*idā*' as '*id*' 'since', which makes better sense, though it hardly seems correct that '*id*' 'doesn't signify consequence at all'. For want of a better suggestion I go with Shehaby.

[5.1.9]

236.16 'assert' (*yaqtaḍī*): This word should mean 'require'. But that makes little sense here. Probably Ibn Sīnā is stretching the sense in view of the derived noun *qaḍīya* 'assertion'.

[5.1.11]

237.1 'with it' (*ma^cahu*): There seem to be two idioms here. First, when Ibn Sīnā says that two propositions are true 'together (*ma^can*)', he normally means that the two propositions are consistent with each other, not that either is in fact true. Second, as here, to say that *q* is true 'with (*ma^ca*)' *p* is to say that in any situation where *p* is true, *q* is true too. The second idiom may not have reached the dictionaries. But here is an example from Al-Ghazālī (Tahafut Part 1, Discussion 1(1), Marmura 12.3):

(59)

[The world] has never ceased to exist with God (*lam yazul mawjūdan ma^ca Allah*).

(From the context, Al-Ghazālī means that at any time when God exists, so does the world.) In this section, Ibn Sīnā's idiom in connection with propositional compounds is the second, 234.6, 235.15, 236.2, 236.10, 237.14. Phrases with the first idiom (*ma^can*) appear three times in the section, but never to explain the sense of a propositional compound.

- 237.4 ‘are strict’: Literally ‘there is strictness of the condition and the consequent’. The Arabic is a bit hamfisted and may be corrupt, but in context the sense is clear. One manuscript has amended ‘strictness’ to ‘strict’.
- 237.4 ‘the positing’: Where we would say that p entails q , Ibn Sīnā often says that the positing (i.e. the act of asserting) p entails q . This is just a usage, not a theory. It could have something to do with Ibn Sīnā’s insistence that an uttered sentence gets its meaning from the speaker’s intentions. But that raises the question where q gets its meaning from, if it hasn’t yet been uttered. (WHAT IN EARLIER AUTHORS?)
- 237.11 ‘On the other hand’: This introduces a brief argument that there is a kind of ‘If ... then’ statement not captured by the previous account — namely where we accept the conditional because we know that the second clause is true, without considering whether there is a link between the two parts. This is not material implication, because (1) Ibn Sīnā doesn’t suggest that we could accept the conditional on the basis that the first clause is false, and (2) in any case Ibn Sīnā’s conditionals normally have an implied quantifier ‘At all times’ or ‘In all cases’.
- 237.11 Here Ibn Sīnā reveals that the implication from first to second clause could be through several steps. The listing of types above already indicates that the implication could use background knowledge.
- 237.15 ‘The first’: Actually the case introduced second in the paragraph.
- 237.15 ‘these two cases’: We can partition true ‘If ... then’ statements into (A) those where there is a link between the two clauses and (B) those which are true accidentally, i.e. not because of a link between the two clauses. Let (C) be the class of ‘If ... then’ statements, i.e. the union of (A) and (B). When Ibn Sīnā talks of one case including another, does he mean that the first is (C) and the second is (A), or does he mean that the first is all ‘If ... then’ propositions and the second is those which assert a link between their clauses? For general reasons I take it he means the latter. But then what is the partition that he has in mind in this clause? The partition into (A) and (B) is restricted to *true* conditionals. The partition into those which *assert* a link and those which don’t is not a partition of the first case. ANSWER: He means that for

each conditional of the first type there is a corresponding conditional of the second type, such that every situation satisfying the second also satisfies the first. His explanation is clearly inadequate; but his normal usage of *'a^camm* is a strong clue.

[5.1.12]

- 238.4 'doesn't have': The switch in English from 'wouldn't have' to 'doesn't have' corresponds to a switch from Arabic *lam yakun* to *laysa*, both of which can be read as indicative.
- 238.15 'both true' (*ṣidquh ma^cah*): If Ibn Sīnā was to keep strictly to his own terminology, this should mean that it's impossible for the first clause to be true whenever the second is. That's clearly the wrong way round; but reversing the two clauses would yield the statement that the conditional is not true, which is not what Ibn Sīnā needs here. The simplest solution is to assume he means that the two clauses can't both be true at once. This is correct, but not everybody will be convinced that it implies what Ibn Sīnā deduces from it.
- 238.16 'that doesn't prevent': Something is wrong here but I can't diagnose what. To make the sentence grammatical I assumed that *mā* 'so long as' should be repeated, giving 'so long as when'. But the sense is still wrong; a conditional has to express that the second clause is or would be true when the first clause is or was true, not that the second clause is 'not prevented from being true'.

[5.1.13]

- 239.1 As Shehaby, I follow two manuscripts in reading the first *nāṭiq* as *nā^ciq*, 'cawing'. The Arabic can be read as either of the two English sentences of (45); Ibn Sīnā's first comment applies to the first reading and his second to the second.
- 239.3 'both of them are false': The reasoning is that if both *p* and *q* are permanently false, then it's not the case that *q* is true whenever *p* is. This needs argument, and perhaps the following is what Ibn Sīnā has in mind. To say that *q* is true whenever *p* is is to say 'Every time at which *p* is true is a time at which *q* is true'. This latter is an affirmative statement, so it is false if it has empty subject,

i.e. if there is no time at which p is true. It's by no means certain that this argument represents Ibn Sīnā's thoughts. The argument uses the proposition (which Ibn Sīnā asserts many times) that every affirmative statement with empty subject is false. In fact the statement ' q is true whenever p is' is also affirmative, but its subject q is an expression which certainly exists; so the argument is highly sensitive to the form of words, and one would expect Ibn Sīnā to discuss this. Also the argument would apply equally well to the absolute reading of (43), but Ibn Sīnā never mentioned it in his discussion of that sentence.

[5.1.14]

239.7 Shehaby must be right to emend '*an* 'that', because it doesn't express entailment. He suggests it should be '*in* 'if'; but 'if' need not express entailment (at least on Ibn Sīnā's account), and more seriously, it isn't in the second clause. I suggest '*īdan* 'therefore' or 'it follows that'. Ibn Sīnā's point is that if the statement (46) expressed entailment, then it would be correct to paraphrase it as 'If humans existed then for that reason (*fa-īdan*) no vacuum exists'; but it isn't.

[5.1.15]

239.16 'commitment' (*taslīm*): The verb *sallama* and its verbal noun *taslīm* are among the commoner words in Ibn Sīnā's logical vocabulary. Dimitri Gutas (in Pamela Huby, *Theophrastus of Eresus: Sources for his Life, Writings, Thought and Influence, Commentary Volume 2, Logic*, Brill, Leiden 2007, p. 191) gives accepted translations: *sallama* 'to admit, to grant', *taslīm* 'admission'. In the present passage the objects of *taslīm* are the obviously impossible premises of a counterfactual argument. It seems odd to talk of admitting something that one doesn't believe, except in the case of confessions under duress; and 'grant' implies there is some actual or imagined person that one is granting something to, which is not the case here. So after some mulling I settled on *sallama* 'to commit oneself to' and *taslīm* 'commitment'. I will set out the reasons more fully when I get a chance. They mainly rest on Ibn Sīnā's usage, but there are also some relevant uses of the words in Iṣḥāq

ibn Ḥusain's translation of a paper of Themistius already in the 9th century. (One should note the cognate word *'islām*, which means surrendering oneself.)

239.17 Reading *dālīka l-ḥaqq* in 239.16 and *dālīka l-bāṭil* in 239.17, rather than the other way round as in all manuscripts. The logic requires our text; in fact one copyist saw this and added the correct statement after the incorrect one.

240.1 Shehaby is clearly right to correct the Cairo text from *kulla ʿadadin zawj* to *kulla zawjin ʿadad*, as in many manuscripts.

240.12 'riding on the back of': It seems this is a metaphor; the word doesn't appear as a technical term elsewhere in Ibn Sīnā's logic.

[5.1.16]

This strange paragraph could just be garbage, but it could also be a rare and precious example of Ibn Sīnā making notes to himself on an unsolved problem. There are hints that he might be working his way to the conclusion that a subjunctive conditional can be true even when the corresponding indicative conditional is false; though his reasons would be rather different from those in the standard modern examples.

240.14 'which is equivalent to it': Whatever can Ibn Sīnā mean? What meet-like propositional compound is equivalent to 'Every *A* is a *B*'? He does somewhere mention the suggestion that it's equivalent to 'If it's an *A* then it's a *B*', but rejects this on the ground that 'it' would have to be quantified. WHERE IS THAT? Or does he mean (54), which is clearly not equivalent to (55)? in any case he makes no further use of this remark.

240.16 'will be true': But it isn't, and hence (55) is false too. But Ibn Sīnā has already described (54), which is supposedly equivalent to (55) as true. Somebody is making notes to sort out an unresolved problem here.

[5.1.17]

240.17 'on its own': This refers to Ibn Sīnā's view that when it occurs as first clause of a compound, the clause is not in fact true or false. REF.

- 240.17 'false': In fact Ibn Sīnā has given no examples where the first clause is false but not necessarily false. There is a problem about giving such examples: Ibn Sīnā counts a conditional as (at least implicitly) starting with a 'whenever'. So the first clause can only be 'false' by being permanently false.
- 241.3 'as a two-sorted statement': The text reads *wujūdan*, which should mean something like 'factually'. But Ibn Sīnā (or at least his manuscripts) is not entirely consistent between pairs like *wujūdan* and *wujūdiyyan*. If he really means the latter, as I suspect, then the point is that there is a hidden time parameter, which is assumed here to be existentially quantified: 'stands still sometimes' and 'moves sometimes'.
- 241.4 'false': because putting the clauses into the compound has the effect of removing the implied existential quantifiers, and replacing them by a wide scope quantifier over the whole. This illustrates Ibn Sīnā's notion of *taḥrīf*, that the meanings of expressions get distorted by their context inside larger sentences.