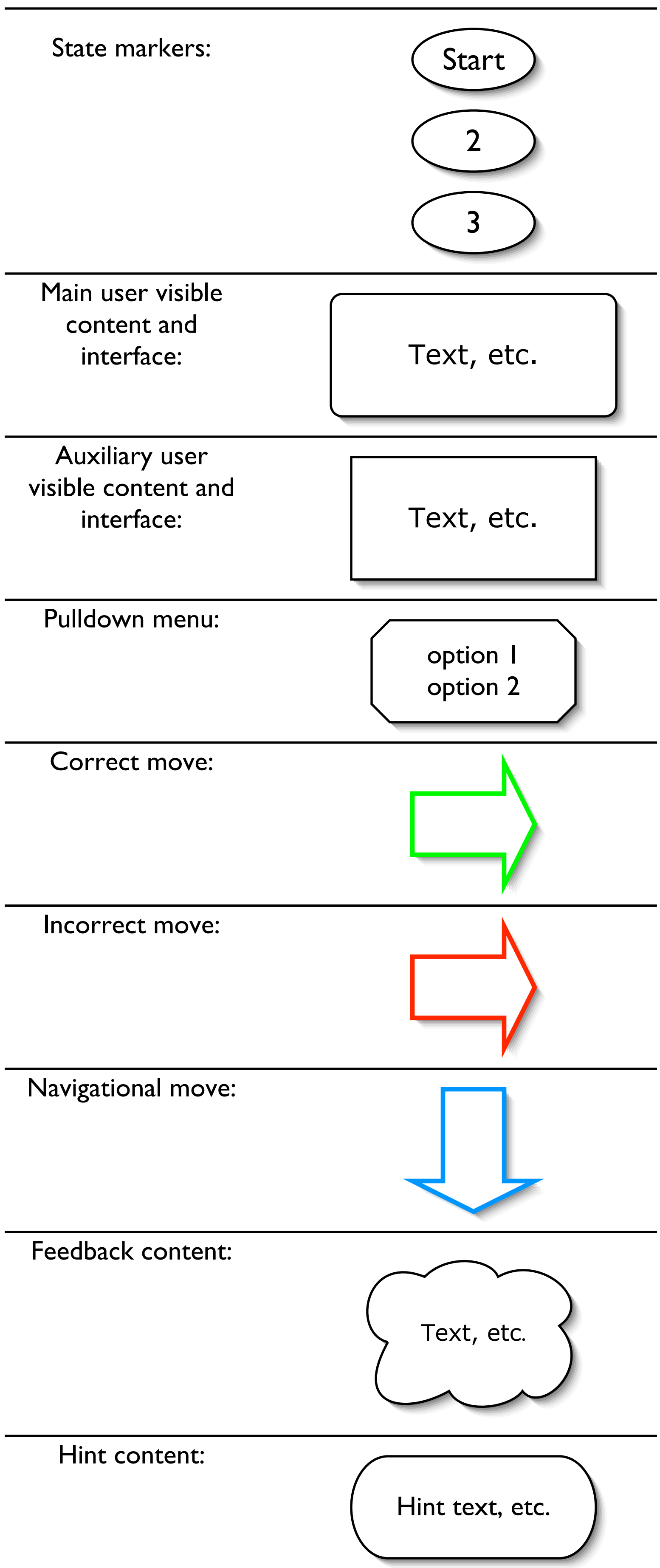
Legend:


State markers:
Start
2
3
Main user visible content and interface:
Text, etc.
Auxiliary user visible content and interface:
Text, etc.
Pulldown menu:
option 1
option 2
Correct move:
Incorrect move:
Navigational move:
Feedback content:
Text, etc.
Hint content:
Hint text, etc.

Start

Complete the following derivation by filling in the missing justification. To fill in the justification on a given line, just click anywhere on that line.

1.	(∀x)(∀y)(R(x,y) & Q(y,x))	Premise
2.	(∃y) Q(a,y)	Premise
3.	Q(a,v)	Assum.
4.	(∀y)(R(a,y) & Q(y,a))	?
5.	R(a,v) & Q(y,a)	?
6.	R(a,v)	&EL: 5
7.	(∃z) R(a,z)	?
8.	(∃z) R(a,z)	?

4 5 7 8

A B C D

Completed derivation:

1.	(∀x)(∀y)(R(x,y) & Q(y,x))	Premise
2.	(∃y) Q(a,y)	Premise
3.	Q(a,v)	Assum.
4.	(∀y)(R(a,y) & Q(y,a))	∀E: 1
5.	R(a,v) & Q(y,a)	∀E: 4
6.	R(a,v)	&EL: 5
7.	(∃z) R(a,z)	∃I: 6
8.	(∃z) R(a,z)	∃E: 2, 7

A

Complete the correct justification for line 4 using the pull-down menus below to fill in the missing components.

∀I ∀E ∃I ∃E	:	1 2 3

∀E → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

∀I → You are correct that it will be one of the rules for universal quantifiers, but you've got the direction wrong.

∃I → The formula on line 4 isn't an existential.

∃E → ∃E takes two lines as justification, not just one.

1 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

2, 3 → The formula on that line isn't a substitution instance of the formula on line 4, nor is the formula on line 4 a substitution instance of it, so the only rule that could potentially have been applied is ∃E, but then a completed subderivation would be required.

B

Complete the correct justification for line 5 using the pull-down menus below to fill in the missing components.

∀I ∀E ∃I ∃E	:	1 2 3 4

∀E → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

∀I → You are correct that it will be one of the rules for universal quantifiers, but you've got the direction wrong.

∃I → The formula on line 5 isn't an existential.

∃E → ∃E takes two lines as justification, not just one.

4 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

1
2
3
→ The formula on that line isn't a substitution instance of the formula on line 5, nor is the formula on line 5 a substitution instance of it, so the only rule that could potentially have been applied is ∃E, but then a completed subderivation would be required.

C

Complete the correct justification for line 7 using the pull-down menus below to fill in the missing components.

∀I ∀E ∃I ∃E	:	3 4 5 6

∃I → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

∀I → You are correct that it will be an introduction rule, but you've got the wrong quantifier.

∀E → There are no universals in the derivation that have the formula on line 7 as a substitution instance.

∃E → ∃E takes two lines as justification, not just one.

6 → answered only this → Good. Now complete the justification by making a selection from the other pull-down menu.

answered both → That's right.

3, 4, 5 → The formula on that line isn't a substitution instance of the formula on line 7, nor is the formula on line 7 a substitution instance of it, so the only rule that could potentially have been applied is ∃E, but then a completed subderivation would be required.

D

Complete the correct justification for line 8 using the pull-down menus below to fill in the missing components.

∀I
∀E
∃I
∃E

: 2 ,

3
4
5
6
7

∃E

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

∀I

Universal introduction can only be used to derive universally quantified formulae, and take only a single line as justification in any case.

∀E

There are no universals in the derivation that have the formula on line 8 as a substitution instance, and the rule takes only a single line as justification in any case.

∃I

∃E takes only a single line as justification, rather than two.

7

answered only this

Good. Now complete the justification by making a selection from the other pull-down menu.

answered both

That's right.

3
4
5

The formula on that line is not a subsitution instance of the formula on line 8, nor vice versa. Also, that formula is not the same as the one on line 8. Thus, none of the rules could possibly be used to derive the formula on line 8 from that line.

6

While the formula on that line is a substitution instance of the formula derived, it cannot serve as justification, since the only line inside a subderivation that can be cited from outside of it is the last line.

Hint sequences by state:

A

If the formula doesn't occur as a subformula of a previous line in the derivation, the next thing to check is whether or not it is a substitution instance of a universally quantified formula.

The formula is a substitution instance of the universally quantified formula on line 1, so it can be derived from that formula using ∀E.

B

If the formula doesn't occur as a subformula of a previous line in the derivation, the next thing to check is whether or not it is a substitution instance of a universally quantified formula.

The formula is a substitution instance of the universally quantified formula just derived on line 4, so it can be derived from that formula using ∀E.

C

If the main operator of a formula is a quantifier, check previous lines for substitution instances.

The formula on line 6 is a substitution instance of this formula, so it could be derived in this case using ∃I.

C

Only one of the four rules for quantifiers takes two lines as justification.

The second line to which ∃E is applied is the formula concluding a subderivation on which the formula to be derived appears.

The last line of the subderivation opened with the assumption of a substitution instance of the existential on line 2, is the same as the formula derived, which means that it can be derived by ∃E applied to lines 2 and 7.