Logic, First Course, Winter 2020. Week 6, Practice Problems. Back to course website

Week 6, Practice Problems

The practice problems fall into two groups:

- Memorizing rules
- Simple proofs

Memorizing rules

The first set of ten problems is just practice in memorizing the rules, with substitution instances. In each case below, the proof is exactly one line long, except for the last two proofs involving arrow introduction, which are three lines long.

Example 1.

exercise

((a ∧ b) ∧ c) ⊢ (a ∧ b)

1. (a∧b)∧c :assumption

Example 2.

exercise

(i ∧ j) ⊢ ((i ∧ j) ∨ k)

1. i∧j :assumption

Example 3.

exercise

(i ∨ j) ⊢ ((i ∨ j) ∨ k)

1. i∨j :assumption

Example 4.

exercise

```
k ⊢ ((i ∧ j) ∨ k)
```

1. k :assumption

Example 5.

exercise

```
d, (d → (e ∧ f)) ⊢ (e ∧ f)
```

1. d :assumption
2. d→(e∧f) :assumption

Example 6.

exercise

```
d, (d → (e ∧ f)) ⊢ (d ∨ e)
```

1. d :assumption
2. d→(e∧f) :assumption

Example 7.

exercise

```
((m ∧ n) → (o ∧ p)), (m ∧ n) ⊢ (o ∧ p)
```

1. (m∧n)→(o∧p) :assumption
2. m∧n :assumption

Example 8.

exercise

```
(h ∨ i), (h → (k ∧ p)), (i → (k ∧ p)) ⊢ (k ∧ p)
```

1. h⋁i :assumption
2. h→(k⋀p) :assumption
3. i→(k⋀p) :assumption

Example 9.

exercise

```
⊤ ⊢ ((a ∧ b) → b)
```

1.

Example 10.

exercise

```
⊤ ⊢ (a → (a ∨ b))
```

1.

Simple proofs

These next set of ten problems are just simple proofs, like the ones done in lecture and section.

Example 11.

exercise

```
((p ∧ q) ∧ r), ((q ∨ s) → t) ⊢ t
```

1. (p∧q)∧r :assumption
2. (q∨s)→t :assumption

Example 12.

exercise

```
p ⊢ (q → (p ∧ q))
```

1. p :assumption

Example 13.

exercise

```
(p → q), (p → r) ⊢ (p → (q ∧ r))
```

1. p→q :assumption
2. p→r :assumption

Example 14.

exercise

```
(p → q), (r → s) ⊢ (p → (r → (q ∧ s)))
```

1. p→q :assumption
2. r→s :assumption

Example 15.

exercise

```
((p ∧ ¬q) ∨ (r ∧ ¬q)) ⊢ ¬q
```

1. (p∧~q)∨(r∧~q) :assumption

Example 16.

exercise

```
(a ∨ b) ⊢ (b ∨ a)
```

1. a∨b :assumption

Example 17.

exercise

```
(p → (r ∧ s)), (q → (r ∧ s)) ⊢ ((p ∨ q) → r)
```

1. p→(r∧s) :assumption
2. q→(r∧s) :assumption

Example 18.

exercise

```
(p → (q ∨ v)), (r → (q ∨ v)), (p ∨ r) ⊢ (q ∨
v)
```

1. p→(q∨v) :assumption
2. r→(q∨v) :assumption
3. p∨r :assumption

Example 19.

exercise

```
((p ∧ ¬q) ∧ r), ((¬p ∨ ¬q) → (u ∧ v)) ⊢ (p ∧
v)
```

1. (p∧~q)∧r :assumption
2. (~p∨~q)→(u∧v) :assumption

Example 20.

exercise

```
((p ∨ q) → r), p, (r → (t ∧ s)) ⊢ s
```

1. (p∨q)→r :assumption
2. p :assumption
3. r→(t∧s) :assumption

This is a practice problem set for this course. It is run on the Carnap software, which is an: