# Assignment3

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## 1 Question 6

1. Romeo loves all females
2. No females love Romeo.
3. Juliet is female.

Romeo loves someone who doesn't love him.

### 1.1 Translate to WFFs

1. $(x)(Fx \supset Lrx)$
2. $(x)(Fx \supset \sim Lxr)$
3. $Fj$

$(\exists x)(Lrx\bullet \sim Lxr)$

### 1.2 S/I rules strictly

4. ASM: $\sim (\exists x)(Lrx\bullet \sim Lxr)$
5. $(x) \sim (Lrx\bullet \sim Lxr)$ {from 4}
6. $(Fj \supset Lrj)$ {from 1}
7. $Lrj$ {from 6}
8. $(Fj \supset \sim Ljr)$ {from 2}
9. $\sim Ljr$ {from 3 and 8}
10. $\sim (Lrj\bullet \sim Ljr)$ {from 5}
11. $Ljr$ {from 7 and 10}
12. $(\exists x)(Lrx\bullet \sim Lxr)$ {from 4; 9 contradicts 11}

### 1.3 Resolution

1. $(x)(Fx \supset Lrx)$

- $(x)(\sim Fx \vee Lrx)$
- Clauses:
  - $\{\sim Fx, Lrx\}$

2. $(x)(Fx \supset \sim Lxr)$

- $(x)(\sim Fx \vee \sim Lxr)$
- Claues:
  - $\{\sim Fx, \sim Lxr\}$

3. $Fj$

- Clauses: $Fj$

4. ASM: $\sim (\exists x)(Lrx \bullet \sim Lxr)$
5. $(x) \sim (Lrx \bullet \sim Lxr)$ {from 4}
6. $(x)(\sim Lrx \vee Lxr)$

- Clauses:
  - $\{\sim Lrx, Lxr\}$
- Substitute $x = j$:
  - $\{\sim Fj, Lrj\}$ {from 1}
  - $\{\sim Fj, \sim Ljr\}$ {from 2}
  - $\{\sim Lrj, Ljr\}$ {from 6}
- Resolving $Fj$ with $\{\sim Fj, Lrj\}$ gives $Lrj$
- Resolving $Fj$ with $\{\sim Fj, \sim Ljr\}$ gives $\sim Ljr$
- Resolving $Lrj$ with $\sim Ljr$ gives empty clause

# 2 Question 18

1. For every positive contigent truth, something explains why it's true.
2. The existence of the world is a positive contigent truth.
3. If something explains the existence of the world, then some necessary being explains the existence of the world.

Some necessary being explains the existence of the world.

## 2.1 Translate to WFFs

1. $(x)(Cx \supset (\exists y)Exy)$
2. $Ce$
3. $(\exists x)Exe \supset (\exists x)(Nx \bullet Exe)$

$(\exists x)(Nx \bullet Exe)$

## 2.2 S/I rules strictly

4. ASM: $\sim (\exists x)(Nx \bullet Exe)$
5. $(x) \sim (Nx \bullet Exe)$ {from 4}
6. $\sim (\exists x)Exe$ {from 3 and 4}
7. $(x) \sim Exe$ {from 6}
8. $(Ce \supset (\exists y)Eye)$ {from 1}
9. $(\exists y)Eye$ {from 2 and 8}
10. $Eae$ {from 9}
11. $(Ca \supset (\exists y)Eya)$ {from 1}
12. $\sim (Na \bullet Eae)$ {from 5}
13. $\sim Na$ {from 10 and 12}
14. $\sim (Ne \bullet Eee)$ {from 5}
15. $\sim Eae$ {from 7}
16. $(\exists x)(Nx \bullet Exe)$ {from 4; 10 contradicts 15}

### 2.3 Resolution

1. $(x)(Cx \supset (\exists y)Exy)$

- $(x)(\sim Cx \vee (\exists y)Exy)$
- Clauses:
  - $\{\sim Cx, Exy\}$

2. $Ce$

- Clauses:
  - $\{Ce\}$

3. $(\exists x)Exe \supset (\exists x)(Nx \bullet Exe)$

- $\sim (\exists x)Exe \vee (\exists x)(Nx \bullet Exe)$
- $(x) \sim Exe \vee (\exists x)(Nx \bullet Exe)$
- $(x) \sim Exe \vee (\exists x)Nx \bullet (x) \sim Exe \vee (\exists x)Exe$
- Clauses:
  - $\{\sim Exe, Nx\}$
  - $\{\sim Exe, Exe\}$

4. ASM: $\sim (\exists x)(Nx \bullet Exe)$

- $(x) \sim (Nx \bullet Exe)$
- $(x)(\sim Nx \vee \sim Exe)$
- Claues:
  - $\{\sim Nx \vee \sim Exe\}$
- Substitute $x = e$:
  - $\{\sim Ce, Eey\}$ {from 1}
  - $\{\sim Eee, Ne\}$ {from 3}
  - $\{\sim Eee, Eee\}$ {from 3}
  - $\{\sim Ne \vee \sim Eee\}$ {from 4}
- Resolving $\{\sim Ce, Eey\}$ with $Ce$ gives $Eey$
- Substitute $y = e$:
  - $\{\sim Ce, Eee\}$ {from 1}
  - $Eee$
- Resolving $\{\sim Eee, Ne\}$ with $Eee$ gives $Ne$
- Resolving $\{\sim Eee, Eee\}$ with $Eee$ gives $Eee$
- Resolving $\{\sim Ne \vee \sim Eee\}$ with $Eee$ gives $\sim Ne$
- Resolving $Ne$ with $\sim Ne$ gives empty clause