UD: all people	Bx: x is a bouncer.	Ixyz: x introduced y to z.
a: Alice	Mx: x is a merchant	Kxy: x knows y.
b: Betty	Px: x is a plumber.	Lxy: x likes y.
c: Chris	Tx: x is tall.	Oxy: x is older than y.

1. No tall bouncer likes Chris.

2. Betty is a tall plumber who knows every bouncer.

3. Some plumber who doesn't like Betty is older than Alice.

4. Betty doesn't like any plumbers, unless she's older than they are.

5. Nobody is tall who isn't older than Chris and Betty.

6. Chris likes everyone he doesn't know.

7. Unless Betty is a plumber, she doesn't know any bouncers who are older than Chris.

8. Chris is older than everyone who Betty introduced to Alice.

9. Alice only likes people who like her.

10. Not every merchant is tall, but Chris likes them all anyway.

11. If some tall plumber knows Chris, then Alice doesn't.

12. Betty only likes those plumbers whom she knows.

13. No one is older than Betty, unless they like her.

14. If Betty likes Chris, she likes everyone.

15. Chris knows everyone who both Alice and Betty like.

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b: Betty	Px: x is a plumber.	Lxy: x likes y.
c: Chris	Tx: x is tall.	Oxy: x is older than y.

16. If anyone is a plumber, everyone is.

17. If anyone is a plumber, Chris is.

18. If anyone is a plumber, they're also tall.

19. Any merchants who are tall are older than Alice.

20. Chris doesn't like anyone Betty didn't introduce him to.

21. Alice is older than any tall merchant.

22. Alice hasn't been introduced to Chris.

23. Every plumber likes some merchant.

24. Alice knows everyone who isn't older than her, unless they're tall.

25. Some merchant who Betty likes knows every tall bouncer.

26. Nobody older than Betty likes anyone older than them.

27. Someone Chris knows doesn't like anyone.

28. Alice is older than everyone who Chris has introduced to someone.

29. Someone tall likes a plumber who likes themselves.

30. Alice knows someone who isn't older than every plumber.

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a: Alice	Mx: x is a merchant	Kxy: x knows y.
b: Betty	Px: x is a plumber.	Lxy: x likes y.
c: Chris	Tx: x is tall.	Oxy: x is older than y.

31. Nobody has been introduced to everyone.

32. Chris likes every bouncer who's older than someone they like.

33. Alice doesn't like any merchant who likes someone Chris knows.

34. Betty doesn't know anyone who is tall but whom no one likes.

35. Someone is older than everyone who likes either Chris or some plumber.

36. No merchant who knows a plumber has introduced anyone to Chris.

37. If anyone likes everyone, that person is older than Chris.

38. Unless everybody likes somebody, there's someone who doesn't like anybody.

39. Alice is a plumber who has introduced every merchant to at least one person.

40. Chris doesn't like anyone who isn't older than every bouncer.

41. Not every bouncer knows someone who doesn't like anybody.

42. Someone who doesn't like anyone is liked by a plumber whom Betty likes.

43. Betty doesn't like any plumbers, unless they like every tall merchant.

44. Every merchant knows someone who they like but who doesn't know them.

45. Chris hasn't introduced anyone to anyone whom Betty knows.

Answers

UD: all people	Bx: x is a bouncer.	Ixyz: x introduced y to z.
a: Alice	Mx: x is a merchant	Kxy: x knows y.
b: Betty	Px: x is a plumber.	Lxy: x likes y.
c: Chris	Tx: x is tall.	Oxy: x is older than y.

1. No tall bouncer likes Chris.
   $\neg\exists x(Tx \,\&\, Bx \,\&\, Lxc)$
   $\forall x((Tx \,\&\, Bx) \rightarrow \neg Lxc)$
2. Betty is a tall plumber who knows every bouncer.
   $Tb \,\&\, Pb \,\&\, \forall x(Bx \rightarrow Kbx)$
3. Some plumber who doesn't like Betty is older than Alice.
   $\exists x(Px \,\&\, \neg Lxb \,\&\, Oxa)$
4. Betty doesn't like any plumbers, unless she's older than they are.
   $\forall x((Px \,\&\, \neg Obx) \rightarrow \neg Lbx)$
   $\forall x((Px \,\&\, Lbx) \rightarrow Obx)$
5. Nobody is tall who isn't older than Chris and Betty.
   $\neg\exists x(Tx \,\&\, \neg(Oxc \,\&\, Oxb))$
   $\forall x((\neg Oxc \vee \neg Oxb) \rightarrow \neg Tx)$
   $\forall x(Tx \rightarrow (Oxc \,\&\, Oxb))$
6. Chris likes everyone he doesn't know.
   $\forall x(\neg Kcx \rightarrow Lcx)$
7. Unless Betty is a plumber, she doesn't know any bouncers who are older than Chris.
   $Pb \vee \neg\exists x(Kbx \,\&\, Oxc)$
8. Chris is older than everyone who Betty introduced to Alice.
   $\forall x(Ibxa \rightarrow Ocx)$
9. Alice only likes people who like her.
   $\forall x(Lax \rightarrow Lxa)$
   $\neg\exists x(Lax \,\&\, \neg Lxa)$
10. Not every merchant is tall, but Chris likes them all anyway.
    $\neg\forall x(Mx \rightarrow Tx) \,\&\, \forall x(Mx \rightarrow Lcx)$
11. If some tall plumber knows Chris, then Alice doesn't.
    $\exists x(Tx \,\&\, Px \,\&\, Kxc) \rightarrow \neg Kac$
12. Betty only likes those plumbers whom she knows.
    $\forall x((Px \,\&\, Lbx) \rightarrow Kbx)$
13. No one is older than Betty, unless they like her.
    $\neg\exists x(Oxb \,\&\, \neg Lxb)$
    $\forall x(\neg Oxb \vee Lxb)$
14. If Betty likes Chris, she likes everyone.
    $Lbc \rightarrow \forall x(Lbx)$
15. Chris knows everyone who both Alice and Betty like.
    $\forall x((Lax \,\&\, Lbx) \rightarrow Kcx)$

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c: Chris	Tx: x is tall.	Oxy: x is older than y.

16. If anyone is a plumber, everyone is.
    $\exists x(Px) \rightarrow \forall x(Px)$
17. If anyone is a plumber, Chris is.
    $\exists x(Px) \rightarrow Cx$
18. If anyone is a plumber, they're also tall.
    $\forall x(Px \rightarrow Tx)$
19. Any merchants who are tall are older than Alice.
    $\forall x((Mx \,\&\, Tx) \rightarrow Oxa)$
20. Chris doesn't like anyone Betty didn't introduce him to.
    If Betty didn't introduce Chris to a person, Chris doesn't like that person.
    $\forall x(\neg Ibcx \rightarrow \neg Lcx)$
    Chris only likes people Betty introduced him to.
    $\forall x(Lxc \rightarrow Ibcx)$
    There's no one Chris likes who Betty didn't introduce him to.
    $\neg\exists x(Lcx \,\&\, \neg Ibcx)$
21. Alice is older than any tall merchant.
    $\forall x((Tx \,\&\, Mx) \rightarrow Oax)$
22. Alice hasn't been introduced to Chris.
    No one introduced Alice to Chris.
    $\neg\exists x(Ixac)$
23. Every plumber likes some merchant.
    $\forall x(Px \rightarrow (x \text{ likes some merchant}))$
    $\forall x(Px \rightarrow \exists y(My \,\&\, Lxy))$
24. Alice knows everyone who isn't older than her, unless they're tall.
    $\forall x(\neg Oxa \rightarrow (Kax \vee Tx)$
25. Some merchant who Betty likes knows every tall bouncer.
    $\exists x(Mx \,\&\, Lbx \,\&\, (x \text{ knows every tall bouncer}))$
    $\exists x(Mx \,\&\, Lbx \,\&\, \forall y[(By \,\&\, Ty) \rightarrow Kxy])$
26. Nobody older than Betty likes anyone older than them.
    $\neg\exists x(Oxb \,\&\, (x \text{ likes someone older than } x))$
    $\neg\exists x(Oxb \,\&\, \exists y(Oyx \,\&\, Lxy))$
27. Someone Chris knows doesn't like anyone.
    $\exists x(Kcx \,\&\, (x \text{ doesn't like anyone}))$
    $\exists x(Kcx \,\&\, \neg\exists y(Lxy))$
28. Alice is older than everyone who Chris has introduced to someone.
    $\forall x((\text{Chris introduced } x \text{ to someone}) \rightarrow Oax)$
    $\forall x(\exists y(Icxy) \rightarrow Oax)$

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c: Chris	Tx: x is tall.	Oxy: x is older than y.

29. Someone tall likes a plumber who likes themselves.
    $\exists x(Tx$ & (x likes a plumber who likes themselves))
    $\exists x(Tx \,\&\, \exists y(Py \,\&\, Lxy \,\&\, Lyy))$
30. Alice knows someone who isn't older than every plumber.
    $\exists x(Kax$ & (x isn't older than every plumber))
    $\exists x(Kax \,\&\, \neg\forall y(Py \rightarrow Oxy))$
31. Nobody has been introduced to everyone.
    $\neg\exists x(x$ has been introduced to everyone)
    $\neg\exists x(\forall y[x$ has been introduced to $y])$
    $\neg\exists x(\forall y[\exists z(Izxy)])$
32. Chris likes every bouncer who's older than someone they like.
    $\forall x([Bx$ & (x is older than someone x likes)] $\rightarrow Lcx)$
    $\forall x([Bx \,\&\, \exists y(Oxy \,\&\, Lxy)] \rightarrow Lcx)$
33. Alice doesn't like any merchant who likes someone Chris knows.
    $\neg\exists x(Mx \,\&\, Lax \,\&\, (x$ likes someone Chris knows))
    $\neg\exists x(Mx \,\&\, Lax \,\&\, \exists y(Lxy \,\&\, Kcy))$
34. Betty doesn't know anyone who is tall but whom no one likes.
    $\neg\exists x(Kbx \,\&\, Tx \,\&$ (no one likes x))
    $\neg\exists x(Kbx \,\&\, Tx \,\&\, \neg\exists y(Lyx))$
35. Someone is older than everyone who likes either Chris or some plumber.
    $\exists x(x$ is older than everyone who likes either Chris or some plumber)
    $\exists x(\forall y[(Lyc \vee (y$ likes some plumber)) $\rightarrow Oxy)$
    $\exists y(\forall y[Lyc \vee \exists z(Pz \,\&\, Lyz)] \rightarrow Oxy)$
36. No merchant who knows a plumber has introduced anyone to Chris.
    $\neg\exists x(Mx$ & (x knows a plumber) & (x introduced someone to Chris))
    $\neg\exists x(Mx \,\&\, \exists y(Py \,\&\, Kxy) \,\&\, \exists y(Ixyc))$
37. If anyone likes everyone, that person is older than Chris.
    If a person likes everyone, they're older than Chris.
    $\forall x((x$ likes everyone) $\rightarrow Oxc)$
    $\forall x(\forall y(Lxy) \rightarrow Oxc)$
38. Unless everybody likes somebody, there's someone who doesn't like anybody.
    $\forall x(x$ likes somebody) $\vee\, \exists x(x$ doesn't like anybody)
    $\forall x(\exists y(Lxy)) \vee \exists x(\neg\exists y(Lxy))$
39. Alice is a plumber who has introduced every merchant to at least one person.
    $Pa \,\&\, \forall x(Mx \rightarrow$ (Alice introduced x to at least one person))
    $Pa \,\&\, \forall x(Mx \rightarrow \exists y(Iaxy))$
40. Chris doesn't like anyone who isn't older than every bouncer.
    $\neg\exists x(Lcx$ & (x isn't older than every bouncer))
    $\neg\exists x(Lcx \,\&\, \neg\forall y(By \rightarrow Oxy))$

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b: Betty	Px: x is a plumber.	Lxy: x likes y.
c: Chris	Tx: x is tall.	Oxy: x is older than y.

41. Not every bouncer knows someone who doesn't like anybody.
    $\neg\forall x(Bx \rightarrow (x$ knows someone who doesn't like anybody))
    $\neg\forall x(Bx \rightarrow \exists y[Kxy \,\&\, (y$ doesn't like anybody)])
    $\neg\forall x(Bx \rightarrow \exists y[Kxy \,\&\, \neg\exists z(Lyz)])$
42. Someone who doesn't like anyone is liked by a plumber whom Betty likes.
    $\exists x((x$ doesn't like anyone) $\&$ (x is liked by a plumber whom Betty likes))
    $\exists x(\neg\exists y(Lxy) \,\&\, \exists y(Py \,\&\, Lby \,\&\, Lyx))$
43. Betty doesn't like any plumbers, unless they like every tall merchant.
    Every plumber whom Betty likes likes every tall merchant.
    $\forall x((Px \,\&\, Lbx) \rightarrow (x$ likes every tall merchant))
    $\forall x((Px \,\&\, Lbx) \rightarrow \forall y[(My \,\&\, Ty) \rightarrow Lxy])$
44. Every merchant knows someone who they like but who doesn't know them.
    $\forall x(Mx \rightarrow (x$ knows someone who they like but who doesn't know them))
    $\forall x(Mx \rightarrow \exists y(Kxy \,\&\, Lxy \,\&\, \neg Kyx))$
45. Chris hasn't introduced anyone to anyone whom Betty knows.
    There's no one whom Chris has introduced to someone Betty knows.
    $\neg\exists x($Chris introduced x to someone Betty knows)
    $\neg\exists x(\exists y(Icxy \,\&\, Kby)$