**1) p∧(q⋁r) ≡ (p∧q)⋁(p∧r)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | q⋁r | pΛq | pΛr | pΛ(q⋁r) | (pΛq)⋁(pΛr) |
| True | True | True | True | True | True | True | True |
| True | True | False | True | True | False | True | True |
| True | False | True | True | False | True | True | True |
| True | False | False | False | False | False | False | False |
| False | True | True | True | False | False | False | False |
| False | True | False | True | False | False | False | False |
| False | False | True | True | False | False | False | False |
| False | False | False | False | False | False | False | False |

**2) a.** *x* is not unhappy.

**b.** People who are happy and rich do not exist.

**c.** Not all happy people are necessarily rich.

**d.** There exists people who are happy if and only because they’re rich, and vice versa.

**e.** In all people, there exists someone who is happy if and only they’re happy, and vice versa.

**3) a. Let P(x,y) means “people who completed all homework” and Q(x) means “people who passed the course.” The domain of discourse of x is “people” and of y is “assignments.”**

∀x∀y(P(x,y)) ⟶ Q(x)

**b. Let P(x) means “people who like to do homework.” The domain of discourse of x is people.**

ㄱ∀x(P(x))

**c. Let P(x, y) means “‘x’ number of friends who took this particular ‘y’ class.” The domain of disclosure of x is friends and of y is class.**

∃y∀x(P(x,y))

**d. Let P(x) means “‘x’ student” and Q(x,y) means “‘x’ student who failed ‘y’ course (Logic and History).” The domain of discourse of x is the student and of y is the course.**

∀x(P(x)) ⟶ ∃x(P(x))ΛQ(x, Logic) ⟶ Q(x, History)

**e. Let P(x,y) means “‘x’ people dance with ‘y’ other people.”**

∀x∀y(P(x,y))

**f. Let P(x, y) means “‘x’ people who danced with Jill danced with ‘y’ other people as well.” The domain of disclosure of x is the people who danced with Jill and of y is the other people.**

∀x∀y(P(x, Jill)) ⟶ P(x, y)

**g.** **Let P(x) mean “‘x’ is Venezuelan.” The domain of discourse of is x is people.**

∃x(P(x)) Λ (∀y(P(y)) ⟶ (y=x)

**4) Let P mean “is sick”, Q mean “lecture will go as planned”, and R means “students are happy.”**

1. Statement 1:

P ⟶ ㄱQ

Statement 2:

Q⋁R

Statement 3:

ㄱR

1. We can infer that the reason why students are not happy is because they need to attend the lecture because having a lecture today or the students being happy (Q⋁R) is a given. Since there the lecture will go as planned, that means you are not sick, since we know that illness means no lecture (P ⟶ ㄱQ)

**5) Let P mean “completed homework”, Q mean “attended all lectures”, R mean “passed the course”, B mean “Bob”, and S means “students.”**

1. Statement 1:

∀x(R(x)) ⟶ P(x)⋁Q(x)

Statement 2:

ㄱQ(B)

Statement 3:

R(B)

1. We know that Bob passed the course and that he did not attend every lecture. Since we know students can pass the course by either completing all homework or attend all lectures (∀x(R(x)) ⟶ P(x)⋁Q(x)), we can conclude that Bob passed the course by completing all homework assignments.