

Assignment 3 cs1303

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1) $D = \{-48, -14, -8, 0, 1, 3, 16, 23, 26, 32, 36\}$

- a) True the smallest odd number is 1
- b) True -48, -14, -8 are all even
- c) False 16, 26, 32 and 36 are all bigger than 0
- d) True 32 is the only number with 2 as its first digit.
- e) False 36 exists.

2) $D = E = \{-2, -1, 0, 1, 2\}$

- a) You need to be able to add 1 value from D to 1 value from E to equal 0 for this to be true.
 $D(0) + E(0) = 0, D(-1) + E(1) = 0, D(1) + E(-1) = 0, D(-2) + E(2) = 0, D(2) + E(-2) = 0.$
- b) You need to be able to add D to E to get E for this to be true
 $D(0) + E(0) = 0, D(0) + E(1) = 1, D(0) + E(-1) = -1, D(0) + E(2) = 2, D(0) + E(-2) = -2.$

3) Please rewrite the following statements formally using quantifiers and variables, and write a negation for each statement

a) Everyone D loves somebody E.

\forall everyone D, \exists somebody E such that D loves E.

Negation: \exists somebody D such that \forall everyone E, D does not love E.

b) Somebody D loves everyone E

\exists everyone D such that \forall someone E, D loves E.

Negation: \forall everyone D, \exists somebody E such that D does not love E.

c) Any even integer equals twice some integer

\forall even integer D, \exists an integer E such that $D = 2E$.

Negation: \exists an integer D such that \forall integers E, $D \neq 2E$

d) Every action has an equal and opposite reaction.

$P(D,E)$ D and E are equal and opposite.

\forall action D, \exists a reaction E such that D and E are equal and opposite.

Negation: \exists action D such that \forall reaction E, D is not equal and opposite to E

e) There is a program that gives the correct answer to every question that is posed to it

\exists program D such that \forall questions posed to E, D provides the correct answer to E.

Negation: \forall program D, \exists question E, such that D does not answer E.

4)

a) Rewrite as: H(x) as healthy person A(x) as an apple a day a for Alice

H(x), then A(x)

A(a)

\therefore H(a)

Invalid because there is a converse error.

b) Rewrite as: S(x) studies discrete mathematics, L(x) good at logic B = bob

$\forall x$ S(x) then L(x)

L(B)

\therefore Q(B)

c) Rewrite as: C(x) be the complication of a computer program produces error messages
and P(x) be the computer program is not correct.

If C(x), then P(x)

$\neg C(x)$

$\therefore \neg P(x)$

Invalid because the, therefore, contains an inverse error.

d) $S()$ the Product of two positive numbers, $A()$ positive

$\forall x \forall y P(x,y)$ then $A(x,y)$

$A(P(x,y))$

\therefore

$A(p,q)$

Invalid converse. Cant have $A(P(x))$

e) $E(x)$ even. $T(x)$ $2x$ is even

$\forall x E(x)$ then $T(x)$

$T(n)$

$\therefore E(n)$

Invalid converse would be valid if $T(n)$ and $E(n)$ were swapped.