TT0: Term Test 0

Timed Assessment

You may start this timed assessment after: Monday, January 25, 2021, 09:00:00 AM

You must start this timed assessment before: Monday, January 25, 2021, 09:00:00 PM

This timed assessment is not available yet.

Duration: 0 hours, 15 minutes

Late submission policy

- A deduction of 0.0% will be applied every 0.25 hours up to 0.25 hours after the assignment is due.
- Thereafter, a deduction of 1.0% will be applied every 0.0166666666666667 hours up to a maximum of 0.0833333333333333 hours.
- Thereafter, a deduction of 5.0% will be applied every 0.0166666666666667 hours up to a maximum of 0.0833333333333333 hours.

ON MARKUS

1 min.
5 mins.

EX: $D = \{$ all strings over $\{a, b, c\}\}$

$\boxed{P(x, y)}$: $\boxed{\text{"}x, y \text{ have same first character"}}$

$\boxed{\text{where } x, y \in D}$ $\longrightarrow$ not a quantifier

```
def fun (x: int):
    ...
```

$\forall x, \forall y, P(x, y)$ ———— $\forall y, \forall x, P(x, y)$

$\underbrace{\forall x \in D, \forall y \in D, P(x, y)}$

$\forall x, y \in D, P(x, y)$ equivalent

$\exists x, y \in D, P(x, y)$ equivalent to $\exists y, x \in D, P(x, y)$

① $\forall x \in D, \exists y \in D, P(x,y)$ ___True___

    • value of y can change depending on x

"for all strings, there is some string that
    starts with the same first character"

$$D \; - \; - \; - \; - \; \overset{x}{\underset{y}{\downarrow}} \; - \; \overset{x}{\underset{y}{\downarrow}} \; - \; - \; - \; - \; -$$

pick $y = x$

② $\exists y \in D, \forall x \in D, P(x,y)$ ___False___

    • value of y must be chosen independently from x

"some string has same first char. as every string"

$\underline{P(\varepsilon, \varepsilon)}$ is True (___vacuously___)

y = abc X

Working with definitions

Def: d divides n   *predicate*   if $n = d \cdot k$ *body*

for some $k \in \mathbb{Z}$

where $d, n \in \mathbb{Z}$ — *domain*

Notation: $d \mid n$ denotes "d divides n"

$3 \mid 27 = \text{True}$ because $27 = 3 \cdot 9$

equivalently: d is a divisor of n

n is a multiple of d

EX 1:   Write a predicate expression
 that means: "every integer that divides 10,
   also divides 100".

$$\forall x \in \mathbb{Z}, \boxed{x \mid 10 \Rightarrow} x \mid 100 \quad \checkmark$$

standard way to say "for all integers
                              that divide 10"

$$D = \{ x \in \mathbb{Z} \mid x \mid 10 \}$$
$$\forall x \in D, \; x \mid 100$$

correct but
not standard
and requires
introducing many
subsets when multiple values.

① $\forall x \in \cancel{\mathbb{Z}}_{①} \; \underline{x \mid 10 \; \wedge \; x \mid 100}$

$\uparrow$

② $\forall x \in \cancel{\mathbb{Z}}_{①} \; \boxed{x \mid 10 \; \Rightarrow \;} \underline{x \mid 100}$

① $\mathbb{Z}: \quad \dots \; -3 \; -2 \; -1 \; 0 \; 1 \; 2 \; 3 \; \dots$
$\qquad\qquad\qquad \times \quad \checkmark \; \smile \; ? \; \smile \; \checkmark \; \times$

② $\mathbb{Z}: \quad \dots \; -5 \; \cancel{-4} \; \cancel{-3} \; -2 \; 1 \; 0 \; 1 \; 2 \; \dots$
$\qquad\qquad \checkmark \; \checkmark \quad \checkmark \; \smile \; \checkmark \; \smile \; \smile$

$\forall x \in \mathbb{Z} \; \wedge$

Expanding definitions

$\forall x \in \mathbb{Z}, \quad x|10 \Rightarrow x|100$

equivalent to:

$\forall x \in \mathbb{Z}, \quad (\exists k_1 \in \mathbb{Z}, 10 = x \cdot k_1) \Rightarrow (\exists k_2 \in \mathbb{Z}, 100 = x \cdot k_2)$

Challenge:

Define predicate $Prime(x)$, where $x \in \mathbb{Z}^+$