Quiz 1 Version I
Fri Sep 28, 2012

SCORE: 19 **/ 25 POINTS**

PLACEMENT REVERSED

Write the **formal definition** of a function used in discrete math. Use correct English and mathematical notation. **SCORE:** 2½ **/ 3 POINTS**

Given sets A and B, a function F in discrete math is a sub set of the Cartesian Product $A \times B$ if, and only if:

1. Given any element $x \in A$, there is an element $y \in B$ such that $(x,y) \in F$

2. For any element $x \in A$ and any $y, z \in B$ if $(x,y) \in F$ and $(x,z) \in F$ then $y = z$.

Let $F = \{1, 3, 4\}$.
Let $G = \{0, 2, 5\}$.
Let K be the relation from F to G defined by xKy if and only if $x^2 + y^2 = 5m$ for some integer m.

SCORE: 6 **/ 6 POINTS**

[a] Write K in set roster notation.

$K = \{(1,2), (4,2)\}$ (1½) (1½)

[b] Is K a function ? Why or why not ?

(1½) K is not a function because not all elements in F, specifically 3, have a corresponding element in G.

[c] If $H = \{b, c\}$, write $H \times G$ in set roster notation.

$H = \{(b,0), (b,2), (b,5), (c,0), (c,2), (c,5)\}$ (1½)

MULTIPLE CHOICE: Which of the following statements are true ?

SCORE: 2 **/ 2 POINTS**

[1] $\{x\} \in \{\{x\}, y, z\}$
[2] $\{x\} \subseteq \{\{x\}, y, z\}$
[3] $\{z\} \subseteq \{\{x\}, y, z\}$

(a) none of the above (b) all of the above (c) only [1] (d) only [2]
(e) only [3] (f) only [1] and [2] (g) only [1] and [3] (h) only [2] and [3]

CONTINUED ➡

Fill in the blanks for the following **formal definitions**. Use proper mathematical notation. SCORE: 1½ / 3 POINTS

[a] The Cartesian product of sets P and Q is

$P \times Q =$ $\{(x, y) \mid x \in P, y \in Q\}$ (1½)

[b] Given sets P and Q, Q is a subset of P (or $Q \subseteq P$) if and only if

Every element in Q is also an element in P

If $W = \{0, 1, 2, 3, 4, 5\}$ and $Y = \{b, c, d, e, f, g, h\}$, SCORE: 1 / 1 POINTS
how many elements are in the Cartesian product of Y and W ?

6 × 7 = 42 (1)

Classify each statement as Universal Existential (**UE**), Existential Universal (**EU**) or Universal Conditional (**UC**). SCORE: 0 / 2 POINTS

[a] Functions which have inverses must be one-to-one. UE

[b] There is a reciprocal for every natural number. ~~EU~~

Let $A = \{x \in Z^* \mid -2 < x \leq 1\}$. Given $\mathbb{Z}^* = \mathbb{Z}^{nonneg...}$ SCORE: 4 / 5 POINTS
Let $B = \{x \in Z \mid x^2 < 3\}$.
Let $C = \{0, 1\}$.

Are the following statements true or false ? Explain **very briefly** your answers. (No points if no explanation given.)

[a] A is a **proper** subset of C False. $A = \{0, 1\}$ (1½) $C = \{0, 1\}$

(1½) All elements in A are also in C, so $A \subseteq C$, But no elements in C are not in A, so A is not a proper subset of C.

[b] $B = C$ False. $B = \{-1, 0, 1\}$ and $C = \{0, 1\}$, so $B \neq C$

(1½)

Rewrite the following statement using the formal existential universal structure mentioned in the lecture notes. SCORE: 2 / 3 POINTS
NOTE: The answer requires 2 variables.
You may use algebra and/or symbolic set notation where appropriate.

"One of the instructors can teach every math class."

"There is an instructor I (1) who, given any math class m, I can teach m." (1)