

CPMS 143 Entry Quiz

So we know what you know. Please do this by yourself and not with a friend.

Name:

- Suppose we have the following predicates $Brother(x, y)$, $Girl(x)$, $Boy(x)$ is a predicate and the universe for the variables x and y is $\{Mary, John, Sally, Henry, Jim\}$. In this universe $John$, $Henry$ and Jim are boys and $Mary$ and $Sally$ are girls. $John$ is the brother of $Mary$ and $Henry$ and Jim are brothers. Which of the following are True?
 - $\forall x \exists y Boy(x) \wedge Brother(x, y)$.
 - $\exists x \forall y Boy(x) \wedge Brother(x, y)$.
 - $\forall x \forall y (Brother(x, y) \rightarrow Boy(x))$.
 - $\exists x \exists y Boy(x) \wedge Girl(y) \wedge Brother(x, y) \wedge x \neq y$.
- Let x and y represent real numbers, and $L(x, y) : x < y$. Write the following statement using this predicate and any needed quantifiers: "There is no largest real number."
- Determine whether each statement is TRUE or FALSE, when A, B and C can be any sets. Justify your answer. (Note: To prove set equality $A = B$, you can prove that every element of A is in B and every element of B is in A)
 - If $A \cup C = B \cup C$, then $A = B$.
 - If $A \cap C = B \cap C$, then $A = B$.
 - If $A \cap B = A \cup B$, then $A = B$.
- Let $A = \{a, b, c\}$. Mark each statement TRUE or FALSE. No need to explain.
 - $\{b, c\} \in \mathcal{P}(A)$
 - $\{\{a\}\} \subseteq \mathcal{P}(A)$
 - $\emptyset \subseteq A$
 - $\{\emptyset\} \subseteq \mathcal{P}(A)$
 - $\emptyset \subseteq A \times A$
 - $\{a, c\} \in A$
 - $\{a, b\} \in A \times A$
 - $(c, c) \in A \times A$

5. A club with 20 women and 17 men needs to choose three different members to be president, vice president, and treasurer.
- (a) In how many ways is this possible?

 - (b) In how many ways is this possible if women will be chosen as president and vice president and a man as treasurer?
6. What is the probability that a fair coin lands Heads 3 times out of 5 flips?
7. You pick a word at random from the set of all words of length six of letters of the alphabet with no repeated letters. What is the probability that the word has exactly one vowel?
8. Consider the following list of sentences.
- The cat slept on the bed.
 - The cat was on the mat.
 - The rat was in its hole.
- (a) What is the probability that the word *the* is followed by *cat*?

 - (b) What is the probability that the word *was* is followed by *in*?

 - (c) What is the probability that the two word (bigram) sequence *the cat* is followed by *was*?

 - (d) Is there a regular expression that would match both *The cat slept on the bed.* and *The cat was on the mat.*? If so, what is it?

 - (e) Do you know anything about the structure of language? For example, do you know what a verb is? What a verb valence would be? What a Part of Speech is?

 - (f) Have you seen ontologies or taxonomies before? For example, that would represent that *a cat* ISA *feline*, and that *a feline* ISA *mammal*?

9. Write a regular expression for each of the following languages. IF YOU HAVE NEVER SEEN REGULAR EXPRESSIONS JUST SAY SO.

(a) the set of all lowercase alphabetic strings ending in a b

(b) the set of all strings from the alphabet a, b such that each a is immediately preceded and immediately followed by a b

(c) the set of all ZIP codes that start with a 9. A ZIP code is a 5 digit number that optionally takes a 4 digit extension separated by a hyphen.

(d) The set of all “magical” dates of the form yyyy-mm-dd. A magical date is one where the last two digits of the year are the same as the month and the day (e.g., 2008-08-08).

10. How much do you know about Python?

11. Anything else you think we might want to know about your background?