

CS 173, Fall 2015
Examlet 13, Part A

NETID:

FIRST:

LAST:

Discussion: Thursday 2 3 4 5 Friday 9 10 11 12 1 2

(15 points) Recall that a phone lattice is a state diagram representing sequences of letters. Each edge in a phone lattice has a single letter on it. In a “deterministic” state diagram, if you look at any state s and any letter a , there is never more than one edge labelled a leaving state s .

Draw a deterministic phone lattice representing exactly the following set of words, using no more than 15 states and, if you can, no more than 13.

moodle, moon, doodle, ogle

moo, moo, mooo, ... [i.e. m followed by two or more o's]

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Examlet 13, Part B

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(5 points) A “red/black tree” is a binary tree, each of whose nodes contains either “red” or “black.” Is the set of all red/black trees countable or uncountable? Briefly justify your answer.

(10 points) Check the (single) box that best characterizes each item.

The set of all intervals $[a, b]$ of the real line.

finite

countably infinite

uncountable

The set of board configurations for the game of chess.

finite

countably infinite

uncountable

Every function from $\{1, 2, 3\}$ to the reals has a finite formula.

true

false

not known

The set of all (finite, unlabelled) graphs, where isomorphic graphs are treated as the same object.

finite

countably infinite

uncountable

$\mathbb{P}(\mathbb{N})$

finite

countably infinite

uncountable

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Review, Part A

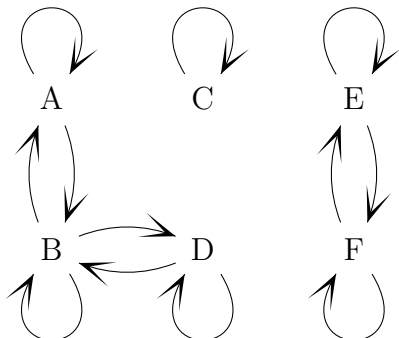
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Discussion: **Thursday** **2** **3** **4** **5** **Friday** **9** **10** **11** **12** **1** **2**

(5 points) Check all boxes that correctly characterize this relation on the set $\{A, B, C, D, E, F\}$.



Reflexive: Irreflexive:

Symmetric: Antisymmetric:

Transitive:

(10 points) Check the (single) box that best characterizes each item.

For any positive integers p , q , and k ,
if $p \equiv q \pmod{k}$, then $p^2 \equiv q^2 \pmod{k}$

true false

$\forall x \in \mathbb{R}$, if $\pi = 3$, then $x < 20$.
(π is the familiar constant.)

true false undefined

$$\sum_{k=0}^{n-1} 2^k$$

$2^n - 2$

$2^n - 1$

$2^{n-1} - 1$

$2^{n+1} - 1$

If $f : \mathbb{Z} \rightarrow \mathbb{R}$ is a function such that
 $f(x) = 2x$ then the set of all even
integers is the _____ of f .

domain co-domain
image

$f : \mathbb{R} \rightarrow \mathbb{Z}$,
 $f(x) = x$

one-to-one not one-to-one not a function

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Review, Part B

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(5 points) Is the graph C_{10} bipartite? Briefly justify your answer.

(10 points) Check the (single) box that best characterizes each item.

Suppose I want to estimate $\frac{103}{20}$.
3 is _____

an upper bound

an exact answer

a lower bound

not a bound on

The chromatic number of the
3-dimensional hypercube Q_3

1

2

3

4

Total number of leaves in a
3-ary tree of height h

3^h

$\leq 3^h$

$\frac{1}{2}(3^{h+1} - 1)$

$3^{h+1} - 1$

$T(1) = d$
 $T(n) = 2T(n-1) + c$

$\Theta(n)$

$\Theta(n^2)$

$\Theta(n \log n)$

$\Theta(2^n)$

The running time of mergesort is $O(n^3)$.

True

False