CS 173, Fall 16
Examlet 13, Part A

NETID:

FIRST: | **LAST:**

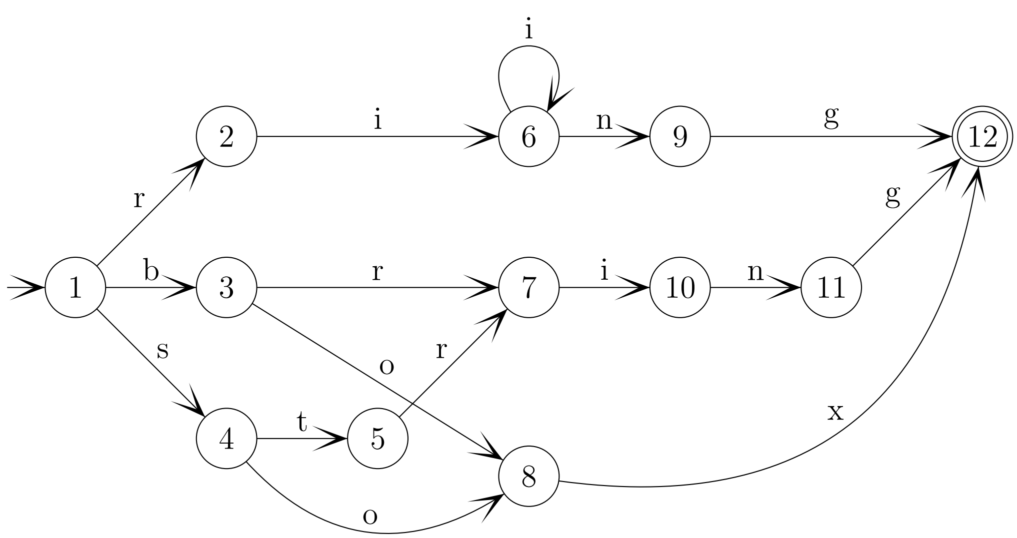
Discussion: Thursday 2 3 4 5 Friday 9 10 11 12 1 2

(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.

bring, string, box, sox
ring, riing, riiing, riiiing, ... [i.e. at least one i between the r and the ng]

Solution:



CS 173, Fall 16
Examlet 13, Part B

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

(5 points) Let's consider two triangles in the real plane to be distinct if they have different shapes, i.e. different. So we ignore size and position/orientation in the plane. Is the set of distinct triangles countable or uncountable? Briefly justify your answer.

Solution: No, this set is not countable. The largest angle can have any real value between 60 degrees to almost 180 degrees. Intervals of the reals are known to be uncountable.

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

$\mathbb{P}(\mathbb{Q})$ has the same cardinality as the reals.	true [√]	false [ ]	not known [ ]
All infinite sequences of emojis.	finite [ ]	countably infinite [ ]	uncountable [√]
There exist mathematical functions that cannot be computed by any C program.	true [√]	false [ ]	not known [ ]
$\mathbb{Q} \times \{\pi, \sqrt{2}\}$	finite [ ]	countably infinite [√]	uncountable [ ]
If $f : A \to B$ is one-to one	$\lvert A\rvert \leq \lvert B\rvert$ [√]	$\lvert A\rvert \geq \lvert B\rvert$ [ ]	$\lvert A\rvert = \lvert B\rvert$ [ ]

CS 173, Fall 16
Review, Part A

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(5 points) Is the cycle graph C_4 a subgraph of graph $K_{3,3}$? Briefly justify your answer.

Solution: Yes, it is. Pick two nodes on each side of $K_{3,3}$ and follow a path back-and-forth between the two sides.

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

If $\sqrt{2}$ is rational, then -3 is positive. — true [√] false [ ] undefined [ ]

If xRx is never true, then the relation R is — reflexive [ ] irreflexive [√] both [ ] neither [ ]

$\forall x \in \mathbb{R}$, if $\pi = 3$, then $x < 20$. (π is the familiar constant.) — true [√] false [ ] undefined [ ]

For any integers p and q, if $p \mid q$ then $p \leq q$. — true [ ] false [√]

If a function from $\mathbb{R}$ to $\mathbb{R}$ is increasing, it must be one-to-one. — true [ ] false [√]

CS 173, Fall 16
Review, Part B

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

(5 points) $A = \{0, 2, 4, 6, 8, 10, 12, \ldots\}$, i.e. the even numbers starting with 0.

$B = \{1, 4, 9, 16, 25, 36, 49, \ldots\}$, i.e. perfect squares starting with 1.

Give a specific formula for a bijection $f : A \to B$. (You do not need to prove that it is a bijection.)

Solution: $f(n) = (\frac{n}{2} + 1)^2$

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

$\sum_{k=1}^{n-1} \frac{1}{2^k}$ $1 - (\frac{1}{2})^n$ ☐ $2 - (\frac{1}{2})^n$ ☐ $1 - (\frac{1}{2})^{n-1}$ ☑ $2 - (\frac{1}{2})^{n-1}$ ☐

Chromatic number of C_n. 2 ☐ 3 ☐ ≤ 3 ☑ ≤ 4 ☐

The number of ways to select a set of 17 flowers chosen from 4 possible varieties (zero or more of each variety).

$\binom{17}{5}$ ☐ $\binom{20}{4}$ ☐ $\binom{20}{3}$ ☑

$\binom{17}{4}$ ☐ $\binom{21}{4}$ ☐ $\frac{17!}{4!}$ ☐

The mathematical symbol for an empty (zero-length) string $\emptyset$ ☐ e ☐ ϵ ☑ NULL ☐

The Marker Making problem can be solved in polynomial time. true ☐ false ☐ not known ☑