Name:____

NetID:________________________ **Lecture:** **A**

Discussion: **Monday & Wednesday** **1:30** **2:30**

(7 points) Donald Knuth has proposed a replacement for conventional resistor codes. In the new system, each resistor has 10 stripes. Each stripe can be either red, blue, or green. The type of resistor is determined by the total amount of each color. E.g. two resistors with 4 red, 5 blue, and 1 green are the same, regardless of the order in which those stripes appear. How many different types of resistor can this code represent? Briefly justify your answer and/or show work.

Solution: This is a combination with repetition problem. We have three types of object (i.e. two dividers) and 10 objects whose type we must choose. So we are choosing 2 positions for the dividers among 12 total positions. So our total number of choices is

$$\binom{10+2}{2} = \binom{12}{2} = \binom{12}{10}$$

(6 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

There is a relish r such that r is orange but r is not spicy.

Solution: For every relish r, r is not orange or r is spicy.

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

How many ways can I choose 10 bagels from among 5 varieties, if I can have any number of bagels from any type?

$\frac{10!}{5!5!}$ ☐	$\frac{14!}{10!4!}$ ☑	$\frac{14!}{9!5!}$ ☐
$\frac{15!}{10!5!}$ ☐	10^5 ☐	5^{10} ☐

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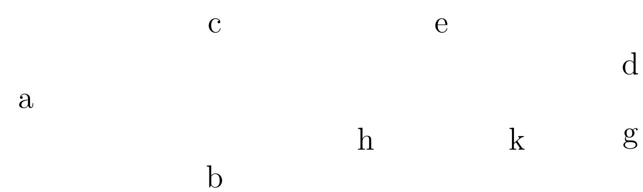
Graph G is at right, with set of nodes V and set of edges E.



Let $f : V \to \mathbb{P}(V)$ such that $f(n) = \{v \in V \mid \text{ there is an edge between } n \text{ and } v\}$.
Let $T = \{f(n) \mid n \in V\}$.

(3 points) $f(b) =$

Solution: $\{a, c, h\}$

(3 points) Is T a partition of V? Check the partition properties that are satisfied.

No Empty set [√] No Partial Overlap [ ] Covers base set [√]

(7 points) Suppose that A and B are sets, C_A is a partition of A and C_B is a partition of B. Is $C_A \cup C_B$ a partition of $A \cup B$? Briefly justify your answer.

Solution: No. Suppose that $A = \{1, 2, 3\}$ and $B = \{1, 2, 4\}$. Then $C_A = \{\{1, 2\}, \{3\}\}$ is a partition of A and $C_A = \{\{1\}, \{2, 4\}\}$ is a partition of B. But $C_A \cup C_B = \{\{1, 2\}, \{3\}, \{1\}, \{2, 4\}\}$ has partial overlap, so it can't be a partition of $A \cup B = \{1, 2, 3, 4\}$.

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

A partition of a set A contains A always [ ] sometimes [√] never [ ]