CS 173, Spring 2015
Examlet 12, Part B

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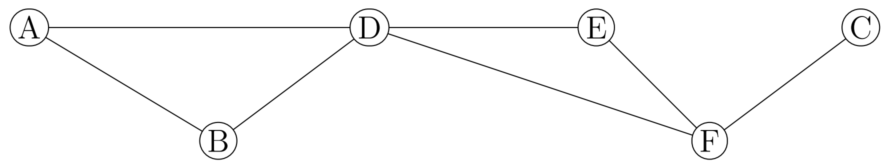
Discussion: **Monday** **9** **10** **11** **12** **1** **2** **3** **4** **5**

Graph G is at right.
V is the set of nodes in G.



Define $f : V \to \mathbb{P}(V)$ by $f(p) = \{n \in V \ : \ \deg(n) \leq \deg(p)\}$, where deg(n) is the degree of node n.
Let $P = \{f(p) \mid p \in V\}$.

(a) (6 points) Fill in the following values:

f(A) =

f(C) =

P =

(b) (7 points) Is P a partition of V? For each of the conditions required to be a partition, briefly explain why P does or doesn't satisfy that condition.

(c) (2 points) State the definition of $\binom{n}{k}$, i.e. express $\binom{n}{k}$ in terms of more basic arithmetic operations.

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Let $f : \mathbb{R} \to \mathbb{P}(\mathbb{R})$ be defined by $f(x) = \{p \in \mathbb{R} \mid \lfloor x \rfloor = \lfloor p \rfloor\}$
Let $T = \{f(x) \mid (x) \in \mathbb{R}\}$.

(a) (6 points) Answer the following questions:

$f(0) =$

Describe (at a high level) the elements of $f(7)$:

The cardinality of (aka the number of elements in) T is:

(b) (7 points) Is T a partition of $\mathbb{R}$? For each of the conditions required to be a partition, briefly explain why T does or doesn't satisfy that condition.

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

$|\{A \subseteq \mathbb{Z}_4 \ : \ |A| \text{ is even}\}|$ 1 ☐ 6 ☐ 7 ☐ 8 ☐ infinite ☐

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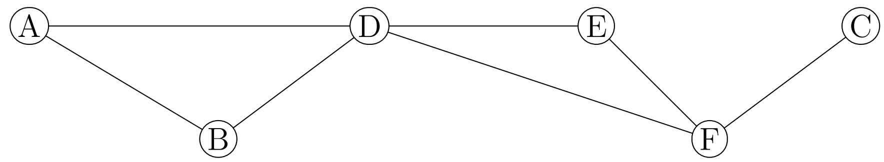
Graph G is at right.
V is the set of nodes in G.
$M = \{0, 1, 2, 3, 4\}$



Define $f : M \to \mathbb{P}(V)$ by $f(n) = \{p \in V \ : \ d(p, F) = n\}$, where $d(a, b)$ is the distance between a and b.
Let $P = \{f(n) \mid n \in M\}$.

(a) (6 points) Fill in the following values:

f(0) =

f(1) =

P =

(b) (7 points) Is P a partition of V? For each of the conditions required to be a partition, briefly explain why P does or doesn't satisfy that condition.

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

$\mathbb{P}(A) \cap \mathbb{P}(B) = \emptyset$ true for all sets ☐ true if $A \cap B = \emptyset$ ☐
false for all sets ☐

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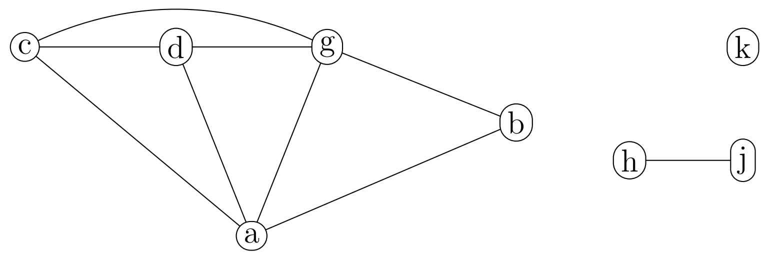
Graph G is at right.
V is the set of nodes.
E is the set of edges.
ab (or ba) is the edge between a and b.



Let $f : V \to \mathbb{P}(E)$ be defined by $f(n) = \{e \in E \mid n \text{ is an endpoint of } e\}$. And let $T = \{f(n) \mid n \in V\}$.

(a) (6 points) Fill in the following values:

$|V| =$

$f(d) =$

$f(h) =$

(b) (7 points) Is T a partition of E? For each of the conditions required to be a partition, briefly explain why T does or doesn't satisfy that condition.

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

$\binom{0}{0}$ -1 ☐ 0 ☐ 1 ☐ 2 ☐ undefined ☐

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(a) (9 points) Suppose that $A_1, A_2, \ldots, A_n$ are non-empty subsets of A, and let $P = \{A_1, A_2, \ldots, A_n\}$. Also suppose that $A_1 \cap A_2 \cap \ldots \cap A_n = \emptyset$ and $A_1 \cup A_2 \cup \ldots \cup A_n = A$. Is P a partition of A? Explain why or why not.

(b) (6 points) Check the (single) box that best characterizes each item.

$\mathbb{P}(A) \cap \mathbb{P}(B) = \mathbb{P}(A \cap B)$

true for all sets ☐ true for some sets ☐

false for all sets ☐

$\{\{a, b\}, c\} = \{a, b, c\}$

True ☐ False ☐

If $f : \mathbb{N} \to \mathbb{P}(\mathbb{Q})$ then $f(3)$ is

a rational ☐ a power set of rationals ☐

a set of rationals ☐ undefined ☐

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Suppose that $A = \{2, 3, 5, 13, 17\}$. Let's define a function $F : A \to \mathbb{P}(A)$ and a set S as follows:

$$\begin{aligned} F(x) &= \{y \in A \mid y \text{ is a factor of } x\} \\ S &= \{F(x) \mid x \in A\} \end{aligned}$$

(a) (2 points) List the members of $F(13)$.

(b) (7 points) Is S a partition of A? Why or why not?

(c) (6 points) Check the (single) box that best characterizes each item.

$\mathbb{P}(A) \cup \mathbb{P}(B) = \mathbb{P}(A \cup B)$ — true for all sets ☐ true for some sets ☐ false for all sets ☐

$\mathbb{P}(\emptyset)$ — $\emptyset$ ☐ $\{\emptyset\}$ ☐ $\{\{\emptyset\}\}$ ☐ $\{\emptyset, \{\emptyset\}\}$ ☐

Pascal's identity states that $\binom{n}{k}$ is equal to — $\binom{n-1}{k} + \binom{n-1}{k-1}$ ☐ $\binom{n-1}{k} + \binom{n-1}{k+1}$ ☐ $\binom{n-1}{k} + \binom{n-2}{k}$ ☐