Name:_____

NetID:_____ **Lecture: A B**

Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (11 points) Let's define two sets as follows:

$$A = \{(x, y) \in \mathbb{R}^2 : y = 3x + 7\}$$

$$B = \{\lambda(-2, 1) + (1 - \lambda)(1, 10) : \lambda \in \mathbb{R}\}$$

Prove that $A = B$ by proving two subset inclusions.

2. (4 points) Check the (single) box that best characterizes each item.

$\sum_{k=0}^{n} \frac{1}{2^k}$ $1 - (\frac{1}{2})^{n-1}$ ☐ $2 - (\frac{1}{2})^{n}$ ☐ $1 - (\frac{1}{2})^{n}$ ☐ $2 - (\frac{1}{2})^{n-1}$ ☐

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

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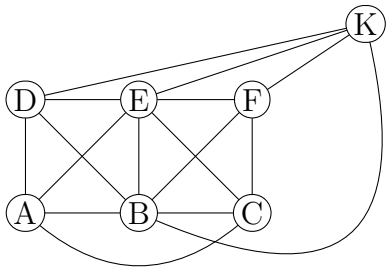
Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (9 points) What is the chromatic number of graph G (below)? Justify your answer.



2. (6 points) Check the (single) box that best characterizes each item.

$\sum_{k=1}^{n} k!$ $\sum_{p=0}^{n+1}(p+1)!$ ☐ $\sum_{k=0}^{n+1}(k-1)!$ ☐ $\sum_{k=0}^{n-1}(k+1)!$ ☐ $\sum_{p=0}^{n+1} k!$ ☐

All elements of M are also elements of X. $M = X$ ☐ $M \subseteq X$ ☐ $X \subseteq M$ ☐

Chromatic number of G $\mathcal{C}(G)$ ☐ $\phi(G)$ ☐ $\chi(G)$ ☐ $\| G \|$ ☐

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Discussion: Thursday Friday 10 11 12 1 2 3 4 5 6

1. (11 points) Recall that if G is a graph, then $\chi(G)$ is its chromatic number. Suppose that G is a graph and H is another graph not connected to G. Suppose G and H each have at least two nodes and at least one edge. Dr. Evil picks two adjacent nodes a and b from G, and also two adjacent nodes c and d from H. He merges G and H into a single graph T by merging b and d into a single node, and adding an edge connecting a and c. So, if G and H are as shown on the left, then T might look as shown on the right.

Describe how $\chi(T)$ is related to $\chi(G)$ and $\chi(H)$, justifying your answer.

2. (4 points) Check the (single) box that best characterizes each item.

$\sum_{k=-2}^{n} k^2$ $\sum_{p=0}^{n+2}(p+2)^2$ ☐ $\sum_{p=0}^{n-2}(p-2)^2$ ☐ $\sum_{p=0}^{n+2}(p-2)^2$ ☐ $\sum_{p=0}^{n+2} p^2$ ☐

W_7 is a subgraph of graph H. 4 is ____ the chromatic number of H.

an upper bound on ☐ exactly ☐

a lower bound on ☐ not a bound on ☐

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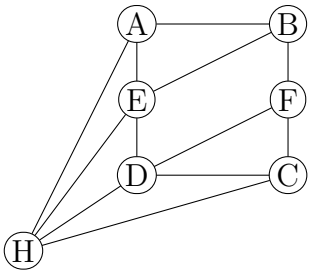
1. (9 points) What is the chromatic number of graph G (below)? Justify your answer.



2. (6 points) Check the (single) box that best characterizes each item.

$\sum_{i=0}^{k-1}(k \cdot i + 2)$

$\frac{k^2(k+1)}{2} + 2k$ ☐ $\frac{k(k+1)}{2} + 2(k-1)$ ☐

$\frac{k^2(k-1)}{2} + 2k$ ☐ $\frac{k(k-1)}{2} + 2(k-1)$ ☐

When I poured 5 gallons of water into the bucket, some spilled over the top. 5 gallons is ____ how much the bucket holds.

an upper bound on ☐ exactly ☐

a lower bound on ☐ not a bound on ☐

Chromatic number of a bipartite graph with at least two vertices.

1 ☐ 2 ☐ 3 ☐ can't tell ☐

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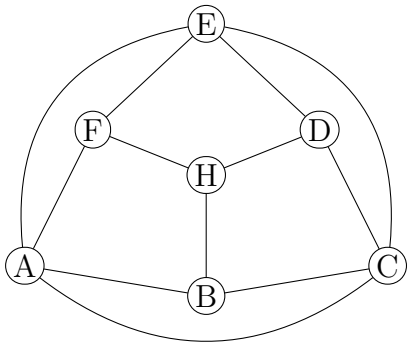
1. (9 points) What is the chromatic number of graph G (below)? Justify your answer.



2. (6 points) Check the (single) box that best characterizes each item.

$\sum_{i=1}^{p-1} i$ $\frac{p(p-1)}{2}$ ☐ $\frac{(p-1)^2}{2}$ ☐ $\frac{p(p+1)}{2}$ ☐ $\frac{(p-1)(p+1)}{2}$ ☐

I heated 2 liters of milk in my big pot. 2 liters is _____ how much the pot holds.

an upper bound on ☐ exactly ☐

a lower bound on ☐ not a bound on ☐

Chromatic number of a graph containing a W_n. ≥ 2 ☐ ≤ 3 ☐ $\geq n$ ☐ can't tell ☐

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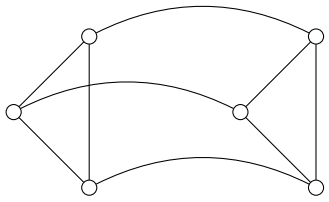
1. (11 points) Recall that if G is a graph, then $\chi(G)$ is its chromatic number. Let's define the "doubled" version of a graph G as follows: make two copies of G and add an edge joining each pair of corresponding nodes. For example, the doubled version of C_3 looks like:



Suppose that T is the doubled version of a graph G. Describe how $\chi(T)$ is related to $\chi(G)$, justifying your answer. Your answer should handle any choice for G, not just C_3.

2. (4 points) Check the (single) box that best characterizes each item.

Chromatic number of W_n. 2 ☐ 3 ☐ ≤ 3 ☐ ≤ 4 ☐

10 people can row the canoe but 11 people caused it to sink. 10 is ____ how many people the canoe can carry.

an upper bound on ☐ exactly ☐

a lower bound on ☐ not a bound on ☐