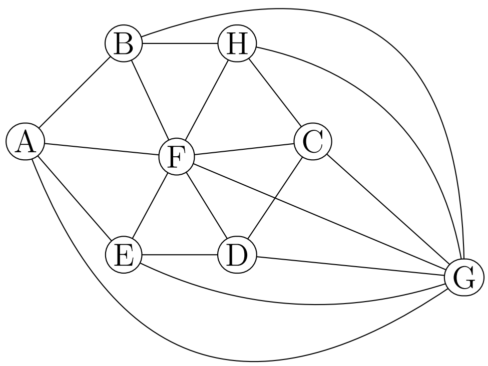
CS 173, Fall 2015
Examlet 7, Part B

NETID:

FIRST: | **LAST:**

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

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.

Exactly 11 Xboxes fit in my suitcase by volume, but I haven't checked their total weight. 11 is ______ how many Xboxes the suitcase can hold.

an upper bound on ☐ exactly ☐
a lower bound on ☐ not a bound on ☐

All elements of M are also elements of X.

$M = X$ ☐ $M \subseteq X$ ☐ $X \subseteq M$ ☐

$\sum_{i=1}^{p-1} i =$

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

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

$$A = \{x \in \mathbb{R} \ : \ |x+1| \leq 2\}$$
$$B = \{w \in \mathbb{R} \ : \ w^2 + 2w - 3 \leq 0\}$$

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

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

I found 143 identical marbles in my saucepan last Saturday. 143 is ____ how many marbles this size will fits in my saucepan.	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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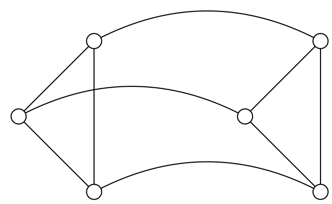
1. (11 points) Recall that if G is a graph, then $\chi(G)$ is its chromatic number. Let's define the "doubled" version of a graph G as follows: make two copies of G and add an edge joining each pair of corresponding nodes. For example, the doubled version of C_3 looks like:



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.

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

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

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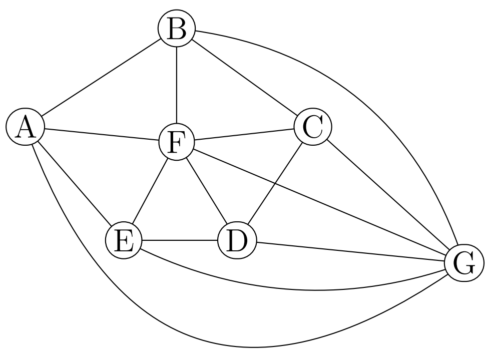
1. (9 points) What is the chromatic number of graph G (below)? Justify your answer.



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

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

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

Putting 10 people in the canoe 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 ☐

The chromatic number of a graph with maximum vertex degree D

$= D$ ☐	$= D + 1$ ☐
$\leq D + 1$ ☐	$\geq D + 1$ ☐

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

$$A = \{(p+1, p) \ : \ p \in \mathbb{R}\}$$
$$B = \{\lambda(1,0) + (1-\lambda)(2,1) \ : \ \lambda \in \mathbb{R}\}$$

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

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

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 C_n. 2 ☐ 3 ☐ ≤ 3 ☐ ≤ 4 ☐

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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.

$\sum_{k=3}^{n} k^7 =$ $\sum_{p=1}^{n-2} p^9$ ☐ $\sum_{p=1}^{n-2} k^7$ ☐ $\sum_{p=1}^{n-2} k^9$ ☐ $\sum_{p=1}^{n-2} (p+2)^7$ ☐

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 ☐