Name:_____

NetID:_____   **Lecture:**   **A**   **B**
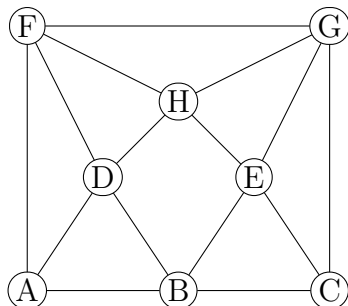
Discussion: **Thursday**   **Friday**   **9   10   11   12   1   2   3   4   5   6**

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

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

Chromatic number of a graph with no cycles and at least one edge   1 ☐   2 ☐   3 ☐   can't tell ☐

15 guests are invited to brunch. Each guest will eat at least two buns.   20 is _____ on how many buns we will need.

an upper bound on ☐   exactly ☐

a lower bound on ☐   not a bound on ☐

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

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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.

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

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

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1. (9 points) What is the chromatic number of the graph below? Justify your answer.
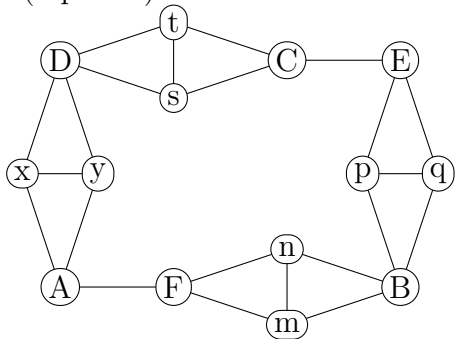
2. (6 points) Check the (single) box that best characterizes each item.

$$\sum_{k=1}^{n-1} \frac{1}{2^k} \qquad 1 - \left(\tfrac{1}{2}\right)^n \ \square \qquad 2 - \left(\tfrac{1}{2}\right)^n \ \square \qquad 1 - \left(\tfrac{1}{2}\right)^{n-1} \ \square \qquad 2 - \left(\tfrac{1}{2}\right)^{n-1} \ \square$$

10 guests are invited to brunch. Each guest will eat at least two buns. 30 is _____ on how many buns we will need.

an upper bound on $\square$ exactly $\square$

a lower bound on $\square$ not a bound on $\square$

Chromatic number of a graph with maximum vertex degree D

$= D$ $\square$ $= D + 1$ $\square$

$\leq D + 1$ $\square$ $\geq D + 1$ $\square$

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1. (11 points) If G is a graph, recall that $\chi(G)$ is its chromatic number. Suppose that G is a graph and H is another graph, not connected to G. Now, create a new graph T which consists of a copy of G, a copy of H, and a new edge that connects some node of G to some node of H. For example, suppose that G is C_5 and H is K_4. Then T might look as follows, where g marks nodes of G and h marks nodes of H, and the new edge is the dashed line.
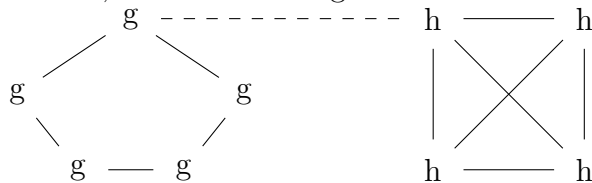
Describe how $\chi(T)$ is related to $\chi(G)$ and $\chi(H)$, justifying your answer. Your answer should handle any choice for G and H.

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

$$\sum_{k=0}^{n-1} 2^k \qquad 2^n - 2 \ \square \qquad 2^n - 1 \ \square \qquad 2^{n-1} - 1 \ \square \qquad 2^{n+1} - 1 \ \square$$

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

Name:_____

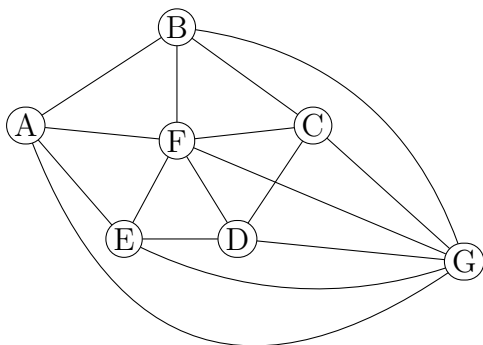**NetID:**_____   **Lecture:**   A   B

Discussion: **Thursday   Friday   9   10   11   12   1   2   3   4   5   6**

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

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

$$\sum_{k=1}^{n} \frac{1}{2^k} \qquad 1 - \left(\tfrac{1}{2}\right)^{n-1} \ \square \qquad 2 - \left(\tfrac{1}{2}\right)^{n} \ \square \qquad 1 - \left(\tfrac{1}{2}\right)^{n} \ \square \qquad 2 - \left(\tfrac{1}{2}\right)^{n-1} \ \square$$

Graph H has 6 nodes. 7 is _____
the chromatic number of H.
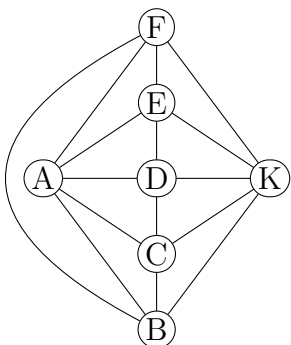
an upper bound on $\square$

a lower bound on $\square$

exactly $\square$

not a bound on $\square$

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

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

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

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

10 students drove home in John's van. 10 is _____ how many students the van can carry.

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

Chromatic number of a graph (with at least one node) and no edges.

1 □   2 □   3 □   can't tell □