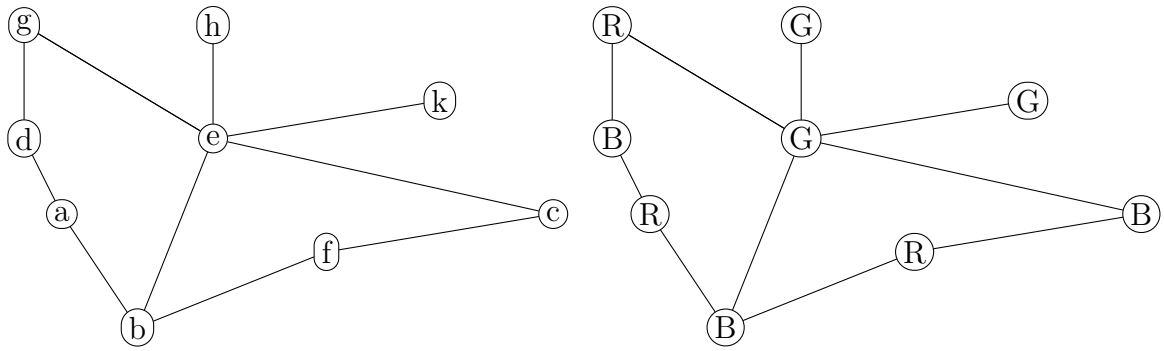
CS 173, Fall 2014
Examlet 7, Part B

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.



Solution: The chromatic number is three. The picture above shows how to color it with three colors (upper bound). For the lower bound, the graph contains a C_5 made up of nodes a, b, e, g, and d.

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

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

W_7 is a subgraph of G. 4 is ____ the chromatic number of G. exactly [ ] a lower bound on [√] an upper bound on [ ]

Chromatic number of G $\mathcal{C}(G)$ [ ] $\phi(G)$ [ ] $\chi(G)$ [√] $\| G \|$ [ ]

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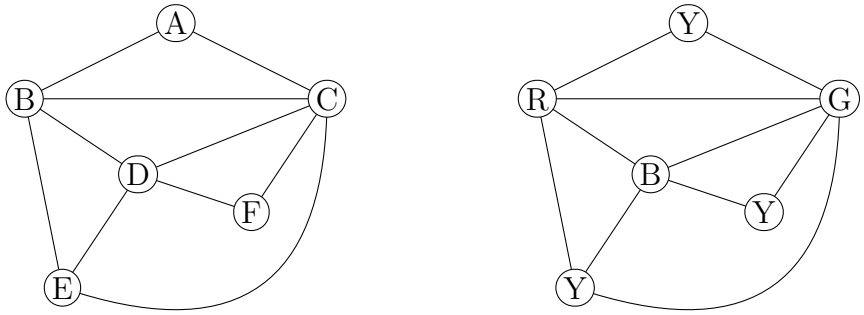

Solution: The chromatic number is four. The picture above shows how to color it with four colors (upper bound). For the lower bound, the graph contains a K_4 made up of nodes B, D, D, E.

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

Chromatic number of a bipartite graph with at least one edge — 1 ☐ 2 ☑ 3 ☐ can't tell ☐

Suppose I want to estimate $\frac{103}{20}$. 3 is _____ — an upper bound ☐ a lower bound ☑ neither ☐

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

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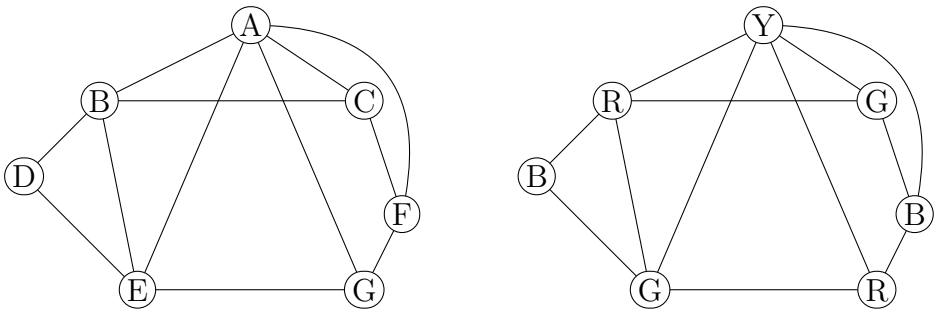

Solution: The chromatic number is four. The picture above shows how to color it with four colors (upper bound). For the lower bound, the graph contains a W_5: the hub is node A and the rim contains nodes B, C, F, G, and E.

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

I found 143 marbles in my saucepan last Saturday. 143 is _____ the number of marbles that fits in my saucepan

exactly ☐ a lower bound on ☑ an upper bound on ☐

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

The chromatic number of a graph with maximum vertex degree D $= D$ ☐ $= D+1$ ☐ $\leq D+1$ ☑

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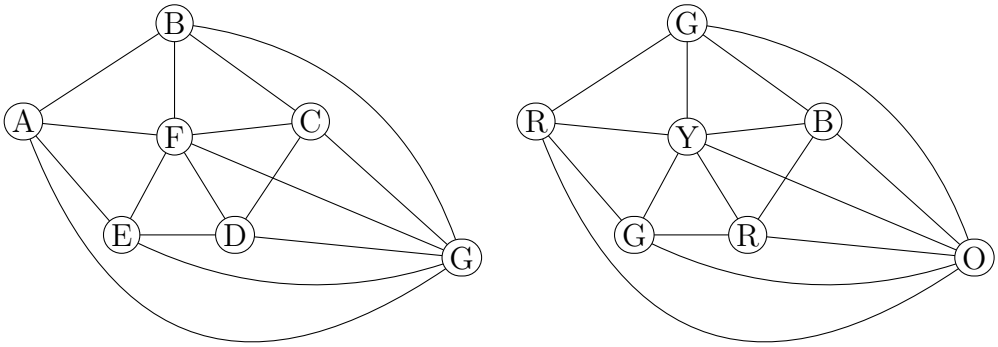
Discussion: **Thursday** **2** **3** **4** **5** **Friday** **9** **10** **11** **12** **1** **2**

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



Solution: The chromatic number is five. The picture above shows how to color it with five colors (upper bound).

For the lower bound, the graph contains a W_5 whose hub is F and whose rim contains nodes A, B, C, D, E. Coloring a W_5 requires four colors. Then the node G is connected to all six nodes in the W_5, so it needs a different, fifth color.

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

Exactly 40 books fit in my suitcase by volume, but I haven't checked their total weight. 40 is ____ on how many books the suitcase can hold.

an upper bound [√] a lower bound [ ]
neither [ ]

All elements of X are also elements of M.

$M = X$ [ ] $M \subseteq X$ [ ] $X \subseteq M$ [√]

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

$1 - (\frac{1}{2})^n$ [ ] $2 - (\frac{1}{2})^n$ [ ] $1 - (\frac{1}{2})^{n-1}$ [√] $2 - (\frac{1}{2})^{n-1}$ [ ]