



Hands-on Activity Handout

Fun and Creative Problem Solving in Mathematics and Computer Science

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Name: _____

Class: _____

Activity Period 1: (5 minutes) [Tourist Problem]**Bus Scheduling DIY: (Do It Yourself)****Tourist Problem Version 1.0**

Given: A list of tourist, each with his/her list of places to visit.

To do: Schedule bus rides for them so that

each tourist visits all the places in his/her list, and

C1: Each tourist visits *at most one place a day*,

C2: There is *at most one bus trip to each place*, and

C3: *minimize* the number of days to complete mission.

An Instance of Tourist Problem	
<u>Tourist</u>	<u>Places of Interest</u>
Aaron	SZG, BG, JB
Betty	CG, JG, BG
Cathy	VC, SI, OR
David	JG, CG, OR
Evans	CG, JG, SZG

Q1: Using the above information, try to schedule the bus trips and minimize the number of days needed to complete all the bus trips.

Day 1: _____

Day 2: _____

Day 3: _____

Day 4: _____

Day 5: _____

Day 6: _____

Q2: What was the key idea you used in your method of scheduling?

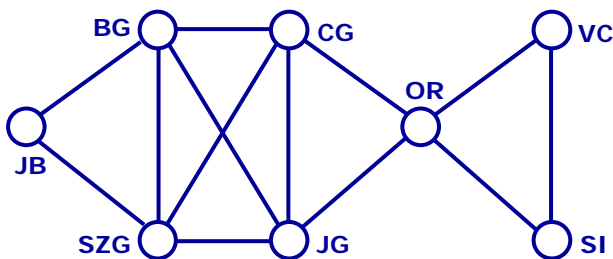
Activity Period 2: (8 minutes) [The Tourist Problem]

The Tourist Problem

Your Name: _____

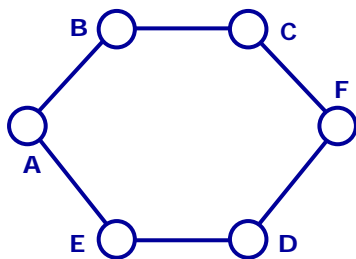
The tourist problem instance in the lecture can be modeled with the following graph. Two possible colourings of the graph are given in the lecture.

Q1: Give a *different* way to colour the vertices of the graph on the left. How many colours?

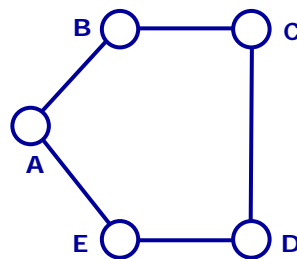


Q1: # colours: _____

Q2: Try coloring the following graphs with the minimum number of colours.

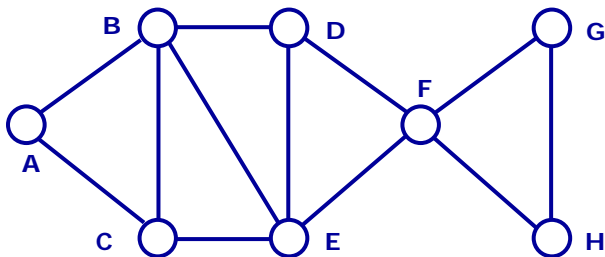


Q2(a): # colours: _____

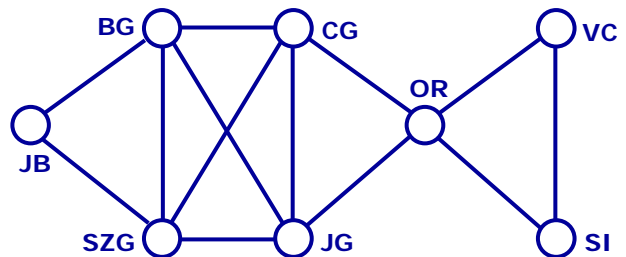


Q2(b): # colours: _____

Q3: What about this one (below, left)?



Q3: # colours: _____



Q4: With 3 colours? YES / NO

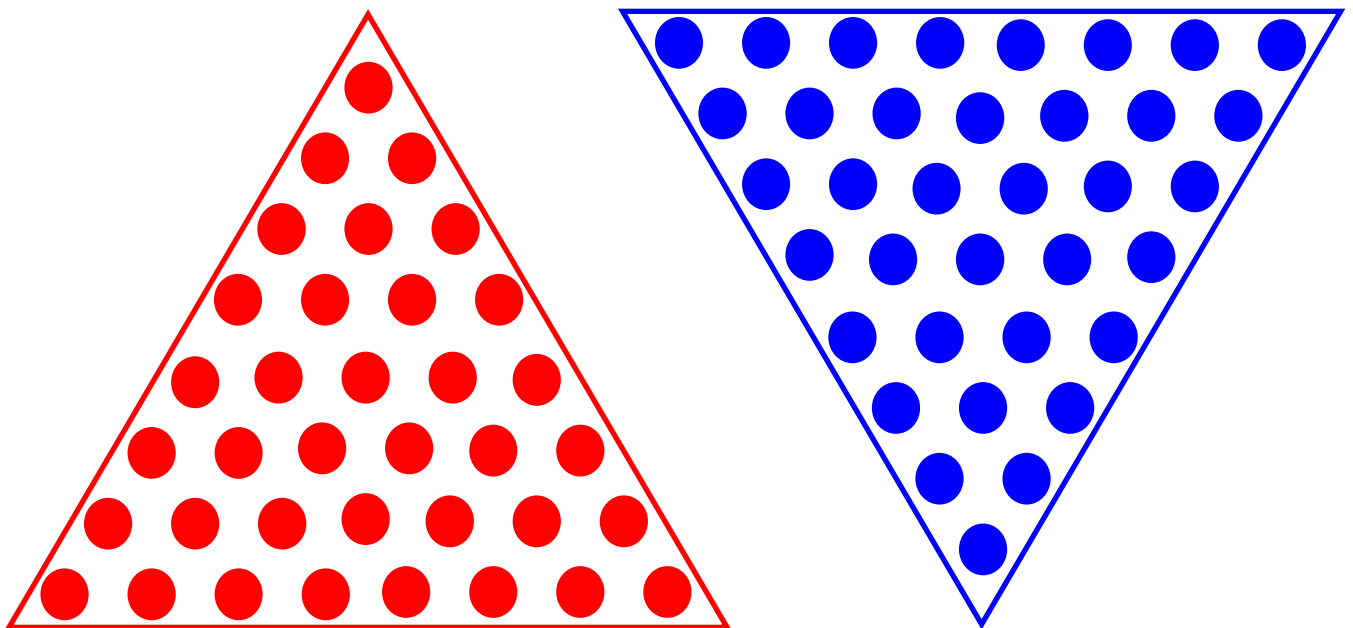
Q4: Can you colour the graph (above, right) with only three (3) colours.

Activity Period #3: (5 minutes) [Inverting a Triangle of Coins, $h = 8$]

Inverting a Coin

Your Name: _____

Invert a triangle of coins of height 8 by moving the minimum number of coins.



Q1: Move the orange triangle around the blue triangle. What is $(a + b + c)$?

Q2: What configuration of $(a + b + c)$ gives the minimum number of coins moved?

Q3: How many coins did you have to move?

TAKE HOME Activity: (8 minutes) [Map Colouring & Fish in a Tank]

Map Colouring

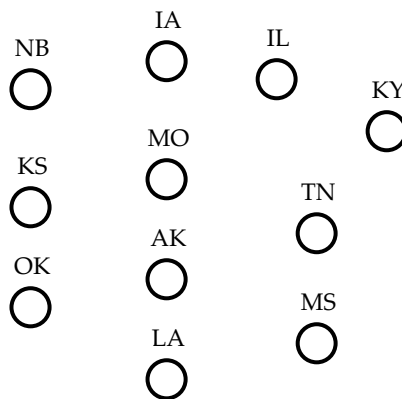
Your Name: _____

Try coloring the following 11 states (of the USA) given in the map below.

[If you do not have so many different colored pencils/pens with you, you can just assign different numbers to the states to mean different colors.]

Q1: How many colors did you use? Can it be done in fewer colors?

Q2: Draw a graph model for the map and then color the graph. Is it easier?



Q3: Now imagine that I give you a large map with 50,000 states (countries). Which is easier – color the map directly, or use graph coloring?

Q4, Q5: (TAKE HOME ACTIVITY) Now repeat Q1 and Q2 with the map given below:



Fish in a Task:

Your Name: _____

A tropical fish hobbyist has six different types of fish: *Angelfish*, *Betta*, *Catfish*, *Danio*, *Eel* and *Fingerfish*, which shall henceforth be designated by A, B, C, D, E, and F, respectively. Because of many factors (including predator-prey relationship, water conditions, and size) some fish can be kept in the same tank, while others *cannot* be together. The table below shows which fish *cannot* be together. (For example, B cannot be together with A, C, or E.)

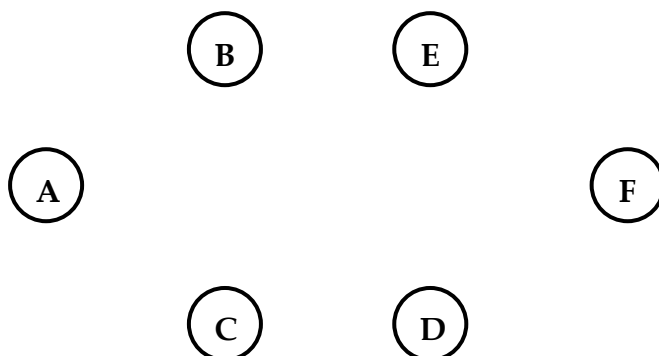
Fish	Conflicts with ...
A	B, C
B	A, C, E
C	A, B, D, E
D	C, F
E	B, C, F
F	D, E



Q1: What is the smallest number of tanks needed to keep *all* the fish?

Use a graph model to help find the answer.

You can start with the partial graph shown below. Add edges to the graph.



Q2: Write down your solution:

Tank #	Conflicts with ...
Tank 1	
Tank 2	
Tank 3	
Tank 4	



Q3: Are there other "equivalent" solutions?

Q4: How is the graph model useful to solving your problem?

TAKE HOME Activity:

Frequency Assignment: (Hands-On Activity)

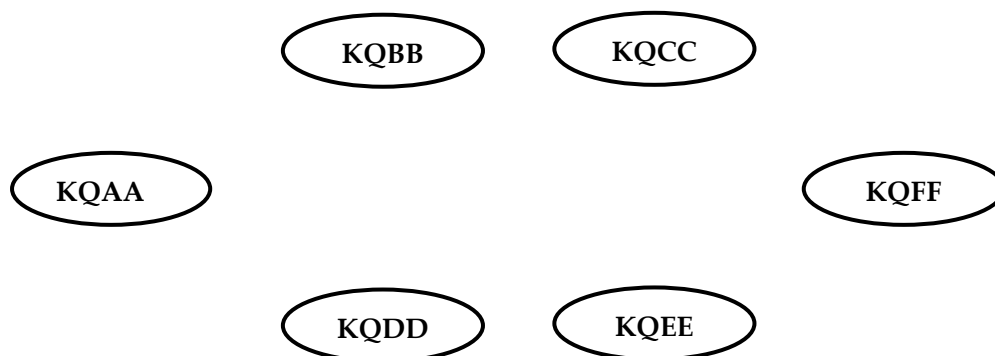
The Federal Communications Commission (FCC) monitors radio stations to make sure that their signals do not interfere with each other. They prevent interference by assigning appropriate frequencies to each station.

How many different frequencies are needed for the six stations located at the distances shown in the table, if two stations cannot use the same channel when they are within 150 miles of each other?

Before you start, think about this: (a) What will each vertex represent? (b). What will each edge represent? (c). How many colours to colour the resulting graph?

	KQAA	KQBB	KQCC	KQDD	KQEE	KQFF
KQAA	-	25	202	77	375	106
KQBB	25	-	175	51	148	222
KQCC	202	175	-	111	365	411
KQDD	77	51	111	-	78	297
KQEE	375	148	365	78	-	227
KQFF	106	222	411	297	227	-

Draw your graph model below:



Q1. How many channel are needed?

Q2. Answer Q1 again if the distance between KQBB & KQFF is changed from 222 to 122?

Q3. What if the distance between KQAA and KQEE is change from 375 to 75?

