**Introduction thru Brain Stormers**

**An Introduction to ...?**
As Prepared by the 2012 ISU REU

**BrainStretcher#1:**
There are 7 kids attending the RedBirdswim camp this summer. The camp counselors have noticed some kids are friends with some or all of the other kids, and are wondering if they can make a visual 'cheat sheet' so they know who is friends with whom. Can you help them out? Here is the information from the counselors:

- **Andrew:** Brad, Cindy
- **Brad:** Andrew, Cindy
- **Cindy:** Andrew, Brad, David, Ellen, Fred, Gail
- **David:** Cindy
- **Ellen:** Cindy, Fred
- **Fred:** Cindy, Ellen, Gail
- **Gail:** Cindy, Fred

**BrainStretcher#1 Possible Answers:**
Let's see what you've made!

**BrainStretcher#1 Sample Answer:**

![Graph](image)

**BrainStretcher#1 Extension:**
Draw your own: $G = ([1,2,3,4], [(1,3), (4,1), (2,3), (3,4)])$

**What we learn from BrainStretcher#1:**
- **Graph**
- **Friendship Graph**
- **Vertex**
- **Edge**
- **How to write a graph relationship:**
What we learn from BrainStretcher #1’s extension:
Isomorphic graphs
Labeling vertices

BrainStretcher #12nd Extension:
How many graphs can you make with three friendships? Remember each friendship is an edge!

BrainStretcher #12nd Extension:
Can these friendships work with our swim campers?

BrainStretcher #12nd Extension:
Can these friendships work with our swim campers?
BrainStretcher#12ndExtension:
Can these friendships work with our swim campers?

BrainStretcher#12ndExtension:
Can these friendships work with our swim campers?

BrainStretcher#2:
The counselors at Red Bird swim camp want to have a weekend activity so more of the kids interact with each other. They decide to hold a ping pong tournament and want to build a schedule. The only problem is that David is homesick with the US only Andrew, Brad, Cindy, Ellen, Fred and Gail can participate. Can you help the counselors create a one-on-one tournament schedule? Let’s start together with round 1.

Round 1:

BrainStretcher2PossibleAnswer:
Let’s see what you come up with for a possible schedule:

Round 1:
Round 2:
Round 3:

Round 4:
Round 5:

BrainStretcher2GraphRepresentation:

What we learn from BrainStretcher#2:
Complete Graph
Proper Coloring
Decomposition
BrainStretcher#2Extension:
Schedule round-robin tournament for 12 people.

What we learn from BrainStretcher#2’s extension:
Starter Graph
Clicking

BrainStretcher#3:
The counselors at Red Bird swim camps saw how successful the ping-pong tournament was at getting the kids to make more friends, so now almost everyone is friends with everyone else. Since David was out sick with the flu for the ping-pong tournament, the counselors wanted to create a tournament of his choosing. David chose the last weekend of camp to host a 3-player video game tournament of Mario Kart Wii on 1 Wii system. Can you come up with a schedule for this tournament such that each pair of campers play together at least once knowing you only have 1 Wii system? Let’s do Round 1 together.

Round 1:

BrainStretcher3 Possible Answer:
Let’s see what you’ve come up with for a possible schedule
Round 1:
Round 2:
Round 3:
Round 4:
Round 5:
Round 6:
Round 7:

BrainStretcher3 Graph Representation:

BrainStretcher3 Graph Representation:
Andrew
Brad
Cindy
Gail
David
Fred
Ellen

What we learn from BrainStretcher#3:
Decomposition
Clicking
Edge Length
BrainStretcher#4: All of the Red Bird camps are coming to an end and the swim campers are joining all the other campers for a Sadie Hawkins End of Camp Dance. The swim campers have decided to join up with the kids at the horse camp. Luckily there are equal numbers of girls and boys, and the girls want to make sure that they each ask one of the boys and no one asks the same boy! To do this the girls need to figure out who knows who and figure out who to ask. Can you help visually organize this information to help the girls figure things out?

Cindy: Andrew, Brad, David, Fred
Ellen: Fred, Mike
Gail: Andrew, Fred
Helen: Mike, Zach
Leslie: Brad, Nick
Phoebe: Fred, Nick, Zach
Susan: Andrew, David

BrainStretcher#4 Possible Answers:
Let's see what you've made!

BrainStretcher#4 Possible Representation:

What we learn from BrainStretcher#4:
Bipartite Graph
Proper Coloring

Problems for you to try!
1) Make as many graphs as possible showing four friendships. (Remember, that means 4 edges!)

2) Make as many graphs as you can between four people showing what possible friendships can exist. (Remember, that means 4 vertices!)