CRAFTY COMBINATIONS

PREPARATION

Grade Levels: 3-5
This activity would be most effective if delivered in three 45 minute to one hour sessions.

Prerequisites
In preparation for this activity, watch the CYBERCHASE episode #111: "A Day at the Spa." In order for the activities to run smoothly, it is important to be familiar with the starting and stopping points in the episode. For the first activity, cue the tape to the part where you see Inez and Digit in the spa dressing room.

Materials Needed
Students will need:
- Clothing and accessories
- Pencils or pens and paper
- Retail catalogues, or magazines with clothing prices
- Scissors, markers, glue or tape, poster board for each group

Group Leader will need:
- Depending on the number of students, you will need three T-shirts and two hats for each small group (there should be no duplicates for each group). Each group will also need two additional accessories of the same type such as: scarves, jewelry, and sunglasses. Each group can receive different types of items. (Depending on the program, you may ask the students to bring in these materials from home).
- Chart paper and markers or blackboard and chalk

Academic Goals
Students will:
- use lists, tables, and tree diagrams to represent total combinations
- select the appropriate method for representing total combinations
- predict the number of combinations using multiplication
- apply learning from made up exercises to real life situations utilizing combinations and calculations

Social Goals
Students will:
- work together in small groups to calculate and keep track of combinations
- collaborate to create tables and tree diagrams using information
- cultivate presentation skills in front of peers

STEPS

**Introductory Activity: ** (20-30 minutes)
1. Divide the students into small groups and give each group three different T-shirts and two hats. Distribute pens or pencils and paper. Tell students that their task is to find out how many outfits are possible – each outfit consists of one t-shirt and one hat. They can write down outfits to keep track of the amount and combinations. After groups finish, ask each group to explain their answer (six outfits).

2. Ask students if there is another way to predict how many outfits are possible, using the number of each item: T-shirts and hats. Students should realize that by multiplying the number of t-shirts by hats they get the total number of possibilities. (This should be especially apparent to older students doing this activity.) Use the chart paper or blackboard to show students, and utilize visuals depending on mathematical level of students.

3. To test their observation, pass out two additional accessories of the same type to each group. Ask each group to predict the number of outfits possible with the new objects. (Twelve. Three T-shirts x two hats x two accessories = 12 possible outfits.) Write the calculation on the board as necessary. Have each group write down their list of outfits. Make sure to collect their lists, which will be used in upcoming activities.

Activity 1: (30 minutes)
1. Tell students they will next watch a few video clips from the Cyberchase episode "A Day at the Spa." In the episode, the Cyberchase team is looking to get the black crystal out of the hands of Hacker.

2. Tell students that in the first segment they should note how Inez and Digit list all of Digit's disguises. If you can't show the video clip from the Web, play the tape to the segment that begins with Inez and Digit in the spa dressing room. Stop the tape when Digit says, "I sure hope this works." Get the student responses to the question posed. (Inez took pictures of each). Ask the students why this was necessary to do. (So Digit could keep track of what disguises were already used.) Ask them what Digit used for his disguises (Three wigs, two sunglasses.), and how many combinations he made (six.) Have students suggest an easier way for Digit and Inez to have counted all the disguises (by multiplying the number of each object: 3 wigs x 2 sunglasses = 6 disguise combinations).

3. Play the next clip, and ask the students to pay attention to how Jackie and Matt kept track of the combinations of doorknobs and keys. If you can't show the clip from the Web, fast forward to the scene where Jackie and Matt are in the Grim Wreaker dungeon trying to escape and stop when Matt says, "Yes" and they both open the dungeon door to leave. Ask students to respond to the question (They made a table using the square tiles on the dungeon floor). Ask how many doorknobs and keys they had (three of each) and how many combinations of one doorknob and one key were possible (nine.) Ask students to recall how many T-shirt and hat combinations they had (six.) Could they have

made a table like Jackie and Matt to keep track of their combinations? (Yes.) Have each group draw their table on a piece of paper. When they have completed the tables, check them, and then have each group draw their table on chart paper to share with the large group.

4. If time permits, have groups present their tables.

Activity 2: (45 minutes – one hour)
1. Have students present their tables if there was not time in Activity 1, or finish presentations. Remind students that each group also received two accessories, and ask how many combinations were possible when they added this third item (twelve.) Ask students if it would be possible to draw a table to keep track of all combinations using three items (no.) Have them support their answer (Tables only have room for two sets of objects.) Tell the students that they're going to watch another clip from Cyberchase. Ask if they have any ideas as to how the Cyberchase team might handle a situation dealing with more than two sets of objects

2. As they watch the clip, ask students to figure out the number and type of controls on the control board. If you can't show the clip from the Web, fast forward the video to the part where the control board is being used to protect the black crystal with a force field. Play the video and pause when Inez says "but there are so many possibilities." Solicit their responses and write the answers on the board (two switches, two levers, three buttons.) Ask how many of each need to be used to cancel the force field (one.) and how many combinations are possible (two x two x three = 12 possible combinations.) Ask students to note how the Cyberchase team keeps track of all possible combinations. Write the students' responses on the board.

3. Tell students to pay attention to what the team used to keep track of the 12 combinations of switches, levers and buttons. If you can't show the next clip from the Web, play the tape and pause when Matt says, "Every path is closed off." Get student responses (a tree diagram). Make the tree diagram on the board and show how it can list all of the combinations. Have each group draw a tree diagram of the three sets of items they used in their combinations. Ask for volunteers to draw their diagram on the board.

4. Ask students if the team was successful in canceling the force field (no) and why (something was missing). Have students pay attention to what was missing from the combinations. If you can't show the next clip from the Web, play the tape and stop when Jackie says "Let's get out of here." Get their response (there was a hidden button). Ask students how the hidden button changed the number of combinations (2x2x4 = 16 combinations.) Point out that by adding one more object, the number of combinations increased from 12 to 16. Go over if students are unsure as to the logic and calculation. Ask students if the team had to start testing all the combinations again (no, they only had four to test). Ask them how the tree diagram had to change (four branches were added to the top). Add four branches to a tree diagram on the paper or blackboard.

5. Ask how you can determine the number of combinations possible when using different sets of objects (multiply the number of objects in each set). Provide another real life example: if they were at an ice cream store and there were four different flavors of ice cream and two types of cones, how many possible one-scoop cones could you make? (eight possible; four flavors x two cones). Ask students to recall the different ways you can illustrate combination possibilities: lists, tables, tree diagrams. Have them explain the difference between tables and tree diagrams – tables can show combinations using two sets of objects, and tree diagrams can also show two combinations, as well as more than two. See if students can come up with other real life examples of how they can use combinations. Answers could include: ordering a pizza with different possible toppings.

Activity 3: (45 minutes – one hour)
Pass out retail catalogues and magazines with prices of clothing and scissors to each student group. Tell each group that their task is to find as many clothing items as possible for under $200 and see how many outfits they can create (an outfit consists of: one shirt, one pair of pants or skirt, one pair of shoes). After they have decided on their clothing and cut it out, pass out glue or tape, markers, and a piece of poster board to each group. Have each group create a poster that shows possible outfits and price. Have students share their posters with peers and post in the room. See which group has the greatest number of combinations for the price.

Extension:
If desired, students can play a related game on the Cyberchase Web site that applies student knowledge of combinations by challenging them to create as many disguises as possible for the Cyberchase team. Go to:
www.pbskids.org/cyberchase/games/combinations/combinations.html
Encourage students to represent different combinations by tables or tree diagrams.

CREDITS
This AFTERSCHOOL EXCHANGE activity was created by Julie Spiegel Ph.D., Educational Specialist at The Point CDC, based on the CYBERCHASE (http://www.pbskids.org/Cyberchase) episode "A Day at the Spa" and the Thirteen NTTI lesson plan "Cyber Combos."
(http://www.thirteen.org/edonline/ntti/resources/lessons/math.html)