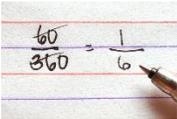
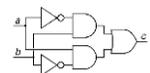
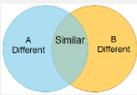


## Table of Effective Heuristic Approaches

		Heuristic	Comment
1		<b>Guess and Check</b>	Narrow possibilities quickly, useful for solving simple problems
2		<b>Make a List</b>	
3		<b>Draw a Diagram</b>	Useful also for timelines
4		<b>Make a Table</b>	Similarly, make a model (mental or physical)
5		<b>Look for a Pattern</b>	
6		<b>Solve a Simpler Problem</b>	If the problem seems too hard and complicated. Divide the problem into sub-problems, do the easy parts first.
7		<b>Experiment</b>	Begin with a hunch
8		<b>Act It Out</b>	
9		<b>Work Backwards/Forwards</b>	Begin with the goal and work to the inputs. For hierarchies: Top Down/Bottom Up
10		<b>Use Deduction (logic)</b>	
11		<b>Change Point of View</b>	If the problem seems unfamiliar. Use your imagination to look at it differently Check for unnecessary constraints
12	$E=mc^2$	<b>Express as an Equation-Use a Variable</b>	
13		<b>Analogy: Reasoning by Comparison</b>	Concepts in one area may be useful in another
14		<b>Ask Someone Else</b>	
15		<b>Take a Break</b>	

# Heuristics Problem Solving Practice

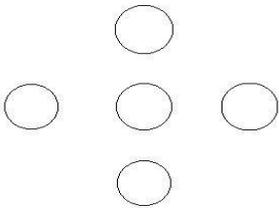
<http://www.as.yasu.edu/~thomasr/PSS%20Student%20problems%202001.pdf>

The objective of these practice problem is to use the 6 step problem process and select and have experience with a range of the heuristic approaches. These are not difficult problems so there is a tendency to skip the formal steps and simply write down the answer. Even if you do this, go back and formally document the individual steps and the heuristic used. This practice strengthens your foundation for solving the more difficult problems that follow.

Solve each of the problems below:

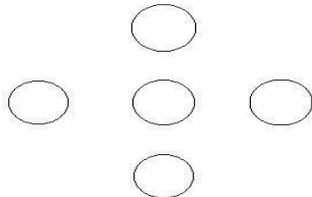
1. Do these exercises on a separate sheet of paper
2. Use the 6 step problem solving process. Lay out your work showing steps 1-6
3. During the "Explore" Step, identify a heuristic to use
4. The Ex # corresponds to Category Number on the Heuristic Chart
5. Compare your heuristic selection with the EX number. The point is expand your repertory and have familiarity with a range of strategies.

1. (Ex. 1) Copy the figure below and place the digits 1, 2, 3, 4, and 5 in these circles so that the sums across (horizontally) and down (vertically) are the same. Is there more than one solution?



2. List all of the 4-digit numbers that can be written using each of 1, 3, 5, and 7 once and only once. Which strategy did you use?

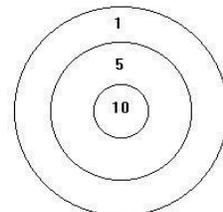
3. Put the numbers 2, 3, 4, 5, and 6 in the circles to make the sum across and the sum down equal to 12. Are other solutions possible? List at least two if possible.



(Ex. 2 )

4. Three darts hit this dart board and each scores a 1, 5, or 10

The total score is the sum of the scores for the three darts. There could be three 1's, two 1's and 5, one 5 and two 10's, And so on. How many different possible total scores could a person get with three darts?



(Ex. 3)

5. In a stock car race, the first five finishers in some order were a Ford, a Pontiac, a Chevrolet, a Buick, and a Dodge.
- The Ford finished seven seconds before the Chevrolet.
  - The Pontiac finished six seconds after the Buick.
  - The Dodge finished eight seconds after the Buick.
  - The Chevrolet finished two seconds before the Pontiac.

In what order did the cars finish the race? What strategy did you use?

6. Four friends ran a race:

Matt finished seven seconds ahead of Ziggy.

Bailey finished three seconds behind Sam.

Ziggy finished five seconds behind Bailey.

In what order did the friends finish the race?

(Ex. 4)

- 7 Cedar Point has a special package for large groups to attend their amusement park: a flat fee of \$20 and \$6 per person. If a club has \$100 to spend on admission, what is the most number of people who can attend?

8 Stacey had 32 coins in a jar. Some of the coins were nickels, the others were dimes. The total value of the coins was \$2.80. Find out how many of each coin there were in the jar. What problem solving strategy did you use?

(Ex. 5)

9 Continue these numerical sequences. Copy the problem and fill in the next three blanks in each part.

a. 1, 4, 7, 10, 13, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

b. 19, 20, 22, 25, 29, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

c. 2, 6, 18, 54, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

10 Copy and continue the numerical sequences:

a) 3, 6, 9, 12, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

b) 27, 23, 19, 15, 11, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

c) 1, 4, 9, 16, 25, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

d) 2, 3, 5, 7, 11, 13, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

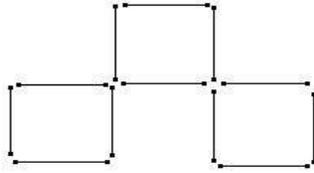
(Ex. 6)

11 The houses on Main Street are numbered consecutively from 1 to 150. How many house numbers contain at least one digit 7?

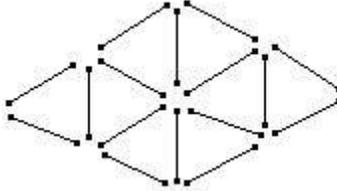
12. The houses on Market Street are numbered consecutively from 1 to 150. How many house numbers contain at least one digit 4?

(Ex. 7)

13. The figure below shows twelve toothpicks arranged to form three squares. How can you form five squares by moving only three toothpicks?



14. Sixteen toothpicks are arranged as shown. Remove four toothpicks so that only four congruent triangles remain.



(Ex. 8)

15. Suppose that you buy a rare stamp for \$15, sell it for \$20, buy it back for \$25, and finally sell it for \$30. How much money did you make or lose in buying and selling this stamp?

16. Suppose that you buy a rare stamp for \$15, sell it for \$20, buy it back for \$22, and finally sell it for \$30. How much money did you make or lose in buying and selling this stamp?

(Ex. 9)

17. Ana gave Bill and Clare as much money as each had. Then Bill gave Ana and Clare as much money as each had. Then Clare gave Ana and Bill as much money as each had. Then each of the three people had \$24. How much money did each have to begin with?

18. I went into a store and spent half of my money and then \$20 more. I went into a second store and spent half of my money and then \$20 more. Then I had no money left. How much money did I have when I went into the first store?

(Ex. 10)

19. Three apples and two pears cost 78 cents. But two apples and three pears cost 82 cents. What is the total cost of one apple and one pear?

20. Five oranges and a banana cost 87 cents. An orange and five bananas cost 99 cents. What is the total cost of two oranges and two bananas?

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(Ex. 11)

21. Show how to draw four line segments through the nine dots shown below without lifting your pencil from the paper.



22. You have six sticks of equal length. Without altering the sticks in any way, show how to arrange them end-to-end to form four equilateral triangles.

Ex. 12

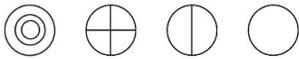
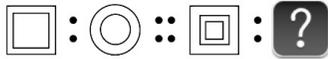
23. Two apples weigh the same as a banana and a cherry. A banana weighs the same as nine cherries. How many cherries weigh the same as one apple?

24. Three pears weigh the same as a quince. A quince weighs as much as eighteen raspberries. How many raspberries weigh the same as a pear?

(Ex 13)

25 Complete the sequence:

Score: 4 / 10 Game Time: 00:00:48



26. Spring Problem (Clement)

A weight is hung on a spring. The original spring is replaced with a spring that has the coils that are twice the diameter of the original. Both springs are made of the same kind of wire and the same number of coils.

Will the new spring stretch from its natural (no load) length, more, less or the same amount under the same weight. (Assume that the mass of the spring is negligible compared to the mass of the weight. What are the reasons for your answer?)

#1-original



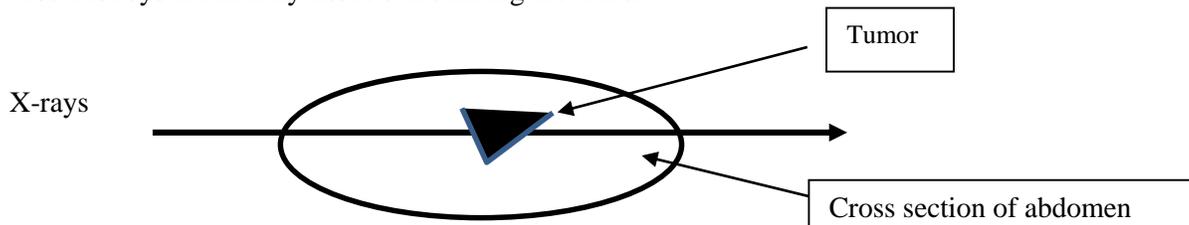
#2-replacement



27. Tumor Problem

Attempt this problem without the hint.

Imagine a person suffers from a malignant tumor in the center of her body. Only strong X-rays can destroy the tumor, but it also destroys the healthy tissue surrounding the tumor.



Hint:  
A general and his troops approached a fortress accessible by many heavily mined roads. If the general's troops took only one road to the fortress, the entire column of soldiers would be killed, and the attack foiled. However, smaller groups could pass safely over the weight-sensitive mines. The general's solution was to divide his soldiers into many small platoons and approach the fortress from different directions.