9

SELF-LEARNING PACKAGE IN

ICT 9

Quarter 1 | Week 4

Pattern Recognition

Learning Competency:

Use common patterns and order to analyze data relevant to the problem.

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Ready to Launch!

In the last lesson, we discussed the first element of computational thinking, which is decomposition. Now let's look at the second, pattern recognition. When we decompose the problem, we frequently find patterns among the sub-problems, for example, similarities or shared characteristics. Discovering these patterns make the complex problem easier to solve since we can use the same solution for each occurrence of the pattern.

Aim at the Target!

At the end of this module you are expected to:

1. *Explain what is pattern recognition.*
2. Solve problems using pattern recognition.

Try This!

Direction. Read carefully the jumbled text inside the box and re-write the correct text.

"I cnduo't bvleiee taht I culod aulaclty uesdtannrd waht I was rdnaieg. Unisg the ic-ndeblire pweor of the hmuan mnid, aocdcrnig to rseecrah at Cmabrigde Uinervtisy, it dseno't mttaer in waht oderr the lterets in a wrod are, the olny irpoamtnt tihng is taht the frsit and lsat ltteer be in the rhgit pclae. The rset can be a taotl mses and you can sitll raed it whoutit a pboerlm. Tihs is bucseae the huamn mnid deos not raed ervey ltteer by istlef, but the wrod as a wlohe. Aaznmig, huh? Yaeh and I awlyas tghhuot slelinpg was ipmorantt! See if yuor fdreins can raed tihs too"

Keep This in Mind!

Pattern recognition in problem solving is key to determining appropriate solutions to problems and knowing how to solve certain types of problems. Recognizing a pattern, or similar characteristics helps break down the problem and also build a construct as a path for the solution. Ever find yourself saying, 'where have I seen this before', could be a significant step in computational thinking.

Once you have decomposed a complex problem, it helps to look for similarities or 'patterns' in each segmented part of the problem. These patterns can help solve the larger problem more effectively. We look for things that have similarity in each order to address the problem. It may be that there are no common elements but it should still be a stage in the process.

Activity. Code breaking

Direction. Analyze the given numbers to decipher the hidden word or group of words. Base your answer in the table given below:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

GIVEN	ANSWER
1) 8 5 12 12 15	**H E L L O**
2) 16 1 20 20 5 18 14 | 18 5 3 15 7 14 9 20 9 15 14	
3) 4 5 3 15 13 16 15 19 9 20 9 15 14	
4) 3 15 13 16 21 20 5 18	
5) 7 18 1 4 5 | 20 5 14 | 12 1 22 15 9 19 9 5 18	

Analysis.

1. Describe how do you find the solution of the problem in this activity?
2. What technique did you developed from answering the activity?

Abstraction and Generalization

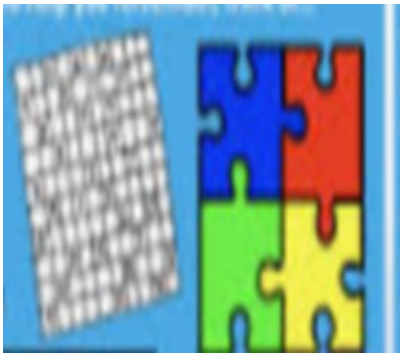
Patterns are opportunities for efficiency when solving problems. Being able to recognize is a fundamental step in the process of Computational Thinking. Patterns help you determine which operations can and need to be done. Recognizing patterns is critical for utilizing computers to automate the solution to a problem. Patterns allow operations to be repeated, saving time.

Pattern recognition can be used to classify data, predict the future, problem solve, and more. Nearly everything we do on a daily basis revolves around patterns in some way, from the things we do when we wake up in the morning, to the way we get work done, to the ways we settle down at night.

Finding a Pattern is a strategy in which students look for patterns in the data in order to solve the problem. Students look for items or numbers that are repeated, or a series of events that repeat. The following problem can be solved by finding a pattern:

There are 1000 lockers in a high school with 1000 students. The first student opens all 1000 lockers; next, the second student closes lockers 2, 4, 6, 8, 10, and so on up to locker 1000; the third student changes the state (opens lockers that are closed, closes lockers that are open) of lockers 3, 6, 9, 12, 15, and so on; the fourth student changes the state of lockers 4, 8, 12, 16, and so on. This continues until every student has had a turn. How many lockers will be open at the end?

Why Is It Important?



Patterns are often introduced to us without the context of a word problem as in the following example:

"Find a pattern in this sequence, explain how it works, and use that pattern to predict the next four numbers. 7, 10, 13, 16, 19, __, __, __, __."

We often discover and continue using patterns that employ geometric shapes. For example, yellow circle, red square, green triangle, yellow circle, red square, green triangle, and so on.

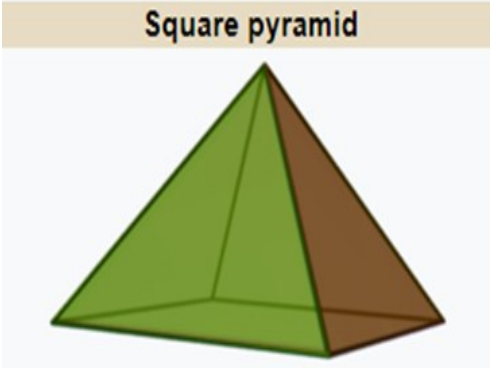
Discovering patterns can help us learn multiplication facts when they notice that 4 x 7 is the same as 7 x 4, and that all numbers in the 10s column end with a zero.

How Can You Make It Happen?

Now, you will be Introduced to a problem that requires to find the pattern in order to solve a problem.

Example 1:

If you build a pyramid with square base using basketballs, how many balls will there be in a pyramid that has six layers?



1. Understand the Problem

Demonstrate that the first step to solving a problem is *understanding* it. This involves identifying the key pieces of information needed to find the answer. This may require you to read the problem several times or put the problem into their own words.

Sometimes you can solve a problem just by recognizing a pattern, but more often you must extend the pattern to find the solution. Making a number table can help you see patterns more clearly.

2. Choose a Strategy

To use this strategy successfully, you need to be sure the pattern will really continue. Give reasons why the pattern is predictable and not based on probability. Problems that are solved most easily by finding a pattern include those that ask to extend a sequence of numbers or to make a prediction based on data. In this problem, you may also choose to make a table or draw a picture to organize and represent their thinking.

Find a Pattern is an appropriate strategy to use to solve the problem. This is a pattern that is predictable and will continue.

3. Solve the Problem

Start with the top layer, or one basketball. Determine how many balls must be under that ball to make the next layer of a pyramid. Use manipulatives if needed. You can use manipulatives of any kind, from coins to cubes to golf balls. You can also draw pictures to help them solve the problem.

You may want to have groups use different manipulatives and then compare their solutions to determine whether the type of manipulative affected the solution.

Layer	Balls added	Balls in this Layer
1 (top)	1	1
2	3	4 (1 + 3 = 4)
3	5	9 (4 + 5 = 9)
4	7	16 (9 + 7 = 16)
5	9	25 (16 + 9 = 25)
6	11	36 (25 + 11 = 36)

If it helps to visualize the pyramid, use manipulatives to create the third layer. Record the number and look for a pattern. The second layer adds 3 basketballs and the next adds 5 basketballs. Each time you add a new layer, the number of basketballs needed to create that layer increases by 2.

1. 1
2. 1 + 3 = 4
3. 4 + 5 = 9

Continue until six layers are recorded. Once a pattern is found, students might not need to use manipulatives.

4. 9 + 7 = 16
5. 16 + 9 = 25
6. 25 + 11 = 36

Then add the basketballs used to make all six layers. The answer is 91 balls. Look at the list to see if there is another pattern. The number of balls used in each level is the square of the layer number. So the 10th layer would have 10 x 10 = 100 balls.

4. Check

Read the problem again to be sure the question was answered.

Yes, I found the total number of basketballs in the six-layer pyramid.
Check the math to be sure it is correct.

1 + 4 + 9 + 16 + 25 + 36 = 91
Determine if the best strategy was chosen for this problem, or if there was another way to solve the problem.

Finding a pattern was a good way to solve this problem because the pattern was predictable.

5. Explain

You should explain your answer and the process they went through to find it. It is important for you to talk or write about your thinking.

For example, First, I started with the first layer. I used blocks to make the pyramid and made a list of the number of blocks that I used. Then I created a table to record the number of balls in each layer.

Layer	Balls added	Balls in this Layer
1 (top)	1	1
2	3	4 (1 + 3 = 4)
3	5	9 (4 + 5 = 9)
4	7	16 (9 + 7 = 16)
5	9	25 (16 + 9 = 25)
6	11	36 (25 + 11 = 36)

I made four layers and then saw a pattern. I saw that for each layer, the number of balls used was the number of the layer multiplied by itself. I finished the pattern without the blocks, by multiplying the number of balls that would be in layers 5 and 6.

Then I added up all of the balls in each layer.
1 + 4 + 9 + 16 + 25 + 36 = 91

I got a total of **91 basketballs.**

Pattern recognition in language understanding

Case example 2: Can you read it?

I cnduo't bvleiee taht I culod aulaclty uesdtannrd waht I was rdnaieg. Unisg the icndeblire pweor of the hmuan mnid, aocdcrnig to rseecrah at Cmabrigde Uinervtisy, it dseno't mttaer in waht oderr the lterets in a wrod are, the olny irpoamtnt tihng is taht the frsit and lsat ltteer be in the rhgit pclae. The rset can be a taotl mses and you can sitll raed it whoutit a pboerlm. Tihs is bucseae the huamn mnid deos not raed ervey ltteer by istlef, but the wrod as a wlohe. Aaznmig, huh? Yaeh and I awlyas tghhuot slelinpg was ipmorantt! See if yuor fdreins can raed tihs too.

Can you read the text effortlessly? Most probably you can. The jumbling of the letters in the individual words pose no barrier to your recognizing the original words in the jumbled text.

As explained in the text, keeping the first and the last letter of every word untouched, **all the other letters** in every word have been **scrambled randomly.** But your mind ignores this scrambling and effortlessly identifies each of the words and continues to read the whole passage without any significant hitch.

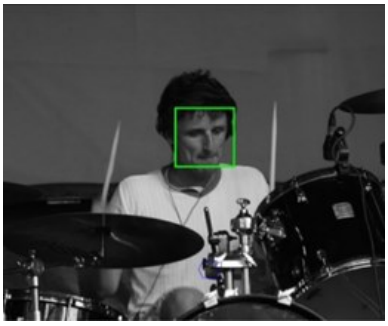
Have you followed any special techniques or methods to achieve this seemingly impossible task? Nope. At least you don't know consciously of any such technique. You just read through.

This example shows inherent pattern recognition power of your mind in language understanding and is in the domain of Cognitive Science or Artificial Intelligence.

Recognizing Patterns for Problem Solving in Everyday Life

We can look for distinguishing attributes (colour, shape, size), extract features or matching patterns.

Example 1: Can you spot the sequence in these numbers ?
{ 1,4,7,10,13,16,19,22,25, }



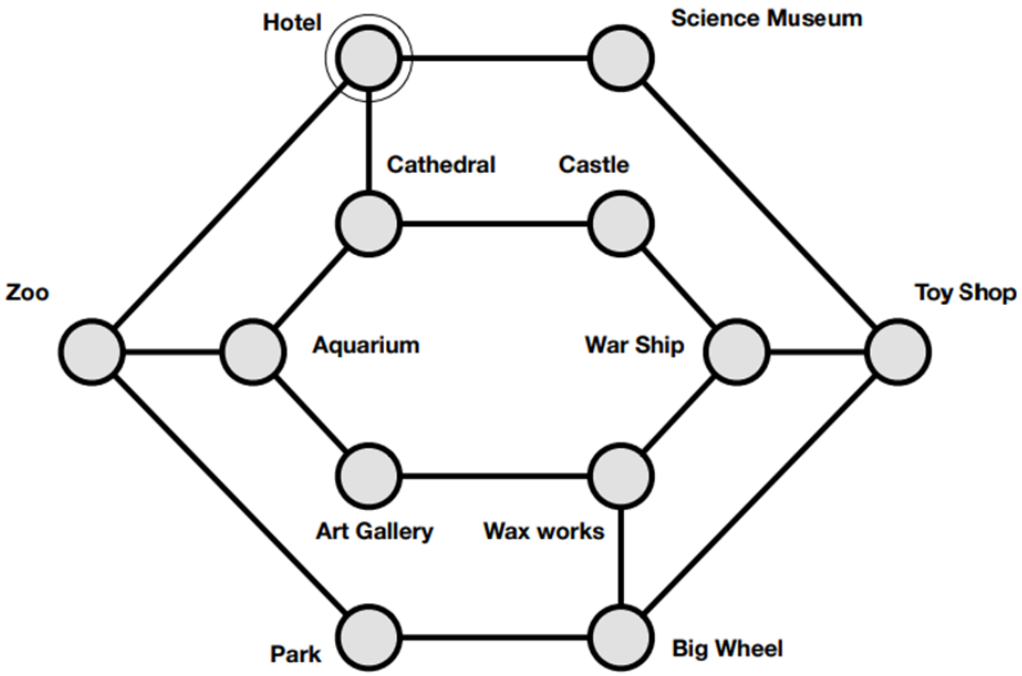
Example 2: How does pattern recognition work on images or photographs. Many people use face recognition in photos when posting to social media. This is based on pattern recognition, similar to fingerprints.

Example 3: Everyone of us has done laundry, with all your clothes including socks. After the socks have dried, you use pattern recognition in order to pair the socks back together. Although there is an algorithm where one method may be faster than another, pattern matching is a key to com posing the solution. There is similarities to finding a shirt of your size in a clothing store. We will relate these examples to modern solutions that deal with many more data items.

Application.

Activity. The Tour guide

You are a hotel tour guide. Tourists staying in your hotel expect to be taken on a tour visiting all the city's attractions. You have been given an underground map that shows all the locations of the attractions and how you can get from one to another using the underground network. **You must work out a route that starts from the hotel and takes your tour group to every tourist site.** The tourists will be unhappy if they pass through the same place twice. They also want to end up back at their hotel that evening.



Reflect

Complete the statements below.

I understand _____

I don't understand _____

I need more information about _____

Reinforcement & Enrichment

Direction: Complete each pattern and write what the rule is.

1) 190, 175, 160, 146, 132, 119, 106, 94 _____, _____, 60, 50, 40, 31, 22, 14, 6.

2) 197, 182, 167, 153, 139, 126, 113, 101, 89, 78, 67, 57, _____, _____, _____, _____, 13

3) 229, 214, 199, 185, 171, _____, 145, 133, 121, 110, 99, 89,79, 70, 61, _____, _____.

Assess Your Learning

I. Multiple Choice. Read each question carefully and select the correct answer. Chose the letter of your choice.

1. What is pattern recognition?
   A. Building models from patterns
   B. Looking for similarities among and within problems
   C. Breaking down a complex problem into smaller problems
2. Why do we need to look for patterns in problems?
   A. Patterns make it easier for us to solve complex problems
   B. Patterns make it more difficult to solve complex problems
   C. We don't need to look for patterns
3. Which of the following contains a pattern?
   A. All cars have wheels B. My car is blue C. My friend's car has an MP3 player
4. Which of the following contains a pattern?
   A. My friend's house has a garden C. My house has a garden
   B. My house has a garden
5. Which of the following does NOT contain a pattern?
   A. Our dogs like walks B. All dogs have tails C. My dog likes swimming
6. Which of the following does NOT contain a pattern?
   A. Some clocks have alarms B. Some clocks are digital C. This clock has hands
7. What might happen if we don't look for patterns?
   A. We might create an incorrect or an inefficient solution C. We might not correctly solve the problem
   B. Our solution may be inefficient

II. Complete each pattern .

8) $8, 7, 8\frac{1}{4}, 7\frac{1}{4}, 8\frac{1}{2}, \_\_\_\_, \_\_\_\_, 7\frac{3}{4}, 9, 8, 9\frac{1}{4}$

9) $14, 3, 14\frac{1}{4}, 3\frac{1}{4}, 14\frac{1}{2}, 3\frac{1}{2}, \_\_\_\_, \_\_\_\_, 15, 4, \_\_\_\_, \_\_\_\_$

10) $\frac{1}{125}, \frac{1}{25}, \frac{1}{5}, (1), (5), (25), (125), (625), \_\_\_\_, \_\_\_\_$

References & Photo Credits

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