

Unit B: Analysis of Games and Numbers

Half Course VI

Please see the print document for more activity suggestions. The document is available from the Manitoba Text Book Bureau (stock number 80354). To order, please visit <www.mtbb.mb.ca>.

HALF COURSE VI

Unit B: Analysis of Games and Numbers

Hours: 7 in combination with Problem Analysis

General Learning Outcome:

Develop, use, and justify mathematical strategies by analyzing a variety of puzzles and games; develop an awareness of how numbers are used in society.

The material provided for this unit could be used throughout the course to provide a change of pace in a context which is enjoyable yet calls for mathematical and logical thinking.

Specific Learning Outcomes

- B-1 Demonstrate the use of an appropriate strategy in solving puzzles and playing games involving patterns.
- B-2 Explain how numbers are used throughout society to designate, categorize, or order things and events.

ANALYSIS OF GAMES AND NUMBERS

Instructional Strategies

- *Essentials of Mathematics 12*
- See Appendix I for possible activities.
- See Appendix II for additional resources.

**PRESCRIBED LEARNING
OUTCOMES**

SUGGESTIONS FOR INSTRUCTION

General Outcome

Develop, use, and justify mathematical strategies by analyzing a variety of puzzles and games; develop an awareness of how numbers are used in society.

Specific Outcome(s)

B-1 demonstrate the use of an appropriate strategy in solving puzzles and playing games involving patterns

The time suggested for this unit is combined with that recommended for Problem Analysis. It is suggested that students and teachers choose learning activities that are of interest and value. It is appropriate for individual students or small groups of students to work concurrently on different learning activities.

Consider interspersing material from this unit throughout the course; i.e., you may wish to spend a few days on this unit early in the course for motivational reasons and then use the learning activities to provide a break between other units, or in the middle of a long unit.

Devote sufficient time to playing and enjoying a game before analysis begins. Then, allow students to discuss the game and articulate their “winning” strategies. Have students explain why a particular strategy works.

Look at extensions of games and puzzles. What happens if you alter certain rules or the number of players?

Have students explain a strategy in written or oral form to another student so that he or she can use it.

The material in Appendix I is designed to be motivational. It may be used in games, organized tournaments, and the like. Competition should be friendly. Students can compete against the teacher or principal as well as with each other.

Communications	✓ Patterns
Connections	Problem Solving
✓ Number Sense	✓ Reasoning
✓ Organization and Structure	Technology
	✓ Visualization

SUGGESTIONS FOR ASSESSMENT	SUGGESTED LEARNING RESOURCES
<p>Participation and the willingness to accept the challenge of the learning activities are important. Keep a daily record.</p> <p>You may wish to keep anecdotal notes on how students develop their strategies.</p> <p>Recreational activities are an appropriate context for journal writing on both content and attitudinal factors.</p>	<p>Print</p> <p><i>Senior 4 Consumer Mathematics (45S) Part V: A Course for Distance Learning.</i> Winnipeg, MB: Manitoba Education, Training and Youth, 2002. — Cover Assignments</p> <p>Baron, C., et al. <i>Essentials of Mathematics 12.</i> Victoria, BC: British Columbia Ministry of Education, 2003. [ISBN 0-7726-4997-9]</p> <p>Blocksma, Mary. <i>Reading the Numbers: A Survival Guide to the Measurements, Numbers, and Sizes Encountered in Everyday Life.</i> Penguin Books, 1989. [ISBN 0-14-01.0654-5]</p> <p>Hopkins, N.J., J.W. Mayne, and J.R. Hudson. <i>The Numbers You Need.</i> Detroit, MI: Gale Research, Inc., 1992. [ISBN 0-8103-8373-X]</p> <p>Muschla, G.R., and J.A. Muschla. <i>Hands-On Math Projects with Real-Life Applications.</i> West Nyack, NY: The Center for Applied Research in Education, 1996. [ISBN 0-87628-384-9]</p> <p>National Council of Teachers of Mathematics. <i>Historical Topics for the Mathematics Classroom.</i> Reston, VA: NCTM, 1989, 1969. [ISBN 0-87353-281-3]</p>

**PRESCRIBED LEARNING
OUTCOMES**

B-2 explain how numbers are used throughout society to designate, categorize, or order things and events

SUGGESTIONS FOR INSTRUCTION

Present topics showing how numbers are used in society and have students discuss the use of numbers. Or, assign various topics to individual students or small groups and have them present how the numbers are used.

Topics might include:

- beads
- digital cameras
- electricity
- Fibonacci sequence
- food labelling
- highways
- insulation
- mineral hardness scales
- paper clips
- pollen count
- prime rate
- radio waves
- sandpaper
- screws and bolts
- typefaces/fonts
- universe (distance)
- wire

Communications	✓ Patterns
Connections	Problem Solving
✓ Number Sense	✓ Reasoning
✓ Organization and Structure	Technology
	✓ Visualization

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING
RESOURCES

Print (continued)

Posamentier, A.S., and J. Stepelman. *Teaching Secondary School Mathematics: Techniques and Enrichment Units*. Toronto, ON: Merrill, 1990.
[ISBN 0-675-21209-X]

Problems for High School Mathematics: Support Document. Winnipeg, MB: Manitoba Education and Training, 1994.
[ISBN 0-7711-1208-4]

Reimer, W., and L. Reimer. *Historical Connections in Mathematics*. Fresno, CA: AIMS Educational Foundation, 1992.
[ISBN 1-881431-35-5]

Sutcliffe, Andrea. *Numbers: How Many, How Long, How Far, How Much . . . All the Numbers You'll Ever Need*. A Stonesong Press Book, Harper Perennial, 1996.
[ISBN 0-06-273362-1]

Note 1: Many bookstores carry problem and puzzle books.

Note 2: *Mathematics Teacher and Mathematics Teaching in the Middle School* from the National Council of Teachers of Mathematics have useful articles and activities.

Appendix I

Teacher Information: Game of Life

Skills Required

- pattern recognition
- visualization
- problem solving

Materials

- Blackline Master of game board or grid paper
- markers in two different colours

When to Use

This activity may be done at any time.

Teaching Suggestions

Students should play the game several times before trying to describe the strategies used.

Blackline Master: Game of Life

This activity is based on a game invented by English mathematician John Conway.

Materials needed:

- “bingo” chips (or something similar) of two different colours
- grid paper (a single copy is provided)

Concept

A cell (bingo chip) lives as a member of a colony. The cell will live or die under certain conditions. The colony will reproduce if suitable conditions exist.

Definition

Any cell, C, has a number of spaces around it called the “neighbourhood” of cell C. In the illustration, all the numbered cells belong to the neighbourhood of C.

1	2	3
4	C	5
6	7	8

Rules of Life

1. Survival. Any cell which has two or three cells in the neighbourhood lives.
2. Death. Any cell which has one or no cells in its neighbourhood dies. Any cell which has four or more cells in the neighbourhood dies of overcrowding.
3. Birth. Into any empty space in the neighbourhood, which has exactly three cells in its neighbourhood, a new cell is born.
4. Births and deaths occur simultaneously in the same cycle.

Process

1. Establish the community with one colour bingo chip (say red).
2. Put in births with the second colour bingo chip (say yellow).
3. Remove dying chips (they can only be red).
4. Replace yellow chips with red chips.
5. Cycle is complete; the process then begins again.

Examples

1. Start

	A			
	B			
		C		

1st Cycle: Births

	A			
	B	ⓓ		
		C		

D is born

Deaths (isolation)

	B	D		

A, C die of isolation

2nd Cycle

No births
B, D die of isolation
Colony dies

2. Start

		B		
	A		C	

1st Cycle: Births

		B		
	A	ⓓ	C	

D is born

Deaths (isolation)

		B		
		D		

A, C die of isolation

2nd Cycle

No births
B, D die of isolation
Colony dies

3. Start

	B	C		
	A			

1st Cycle: Births

	B	C		
	A	ⓓ		

D is born

No deaths

	B	C		
	A	D		

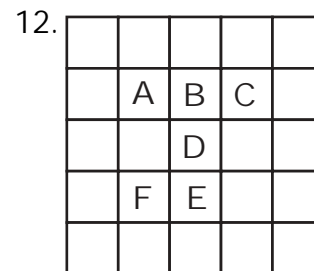
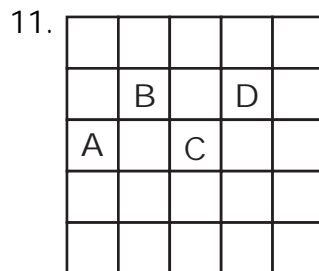
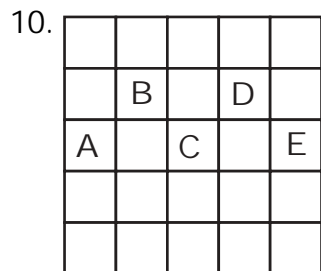
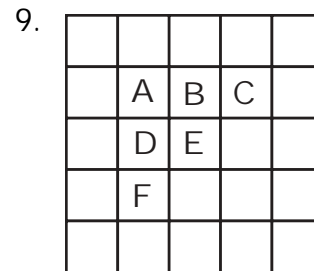
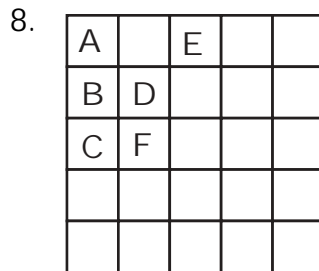
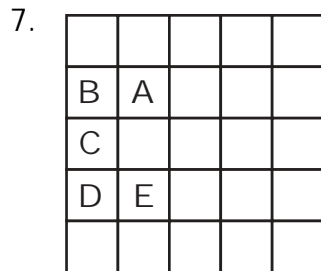
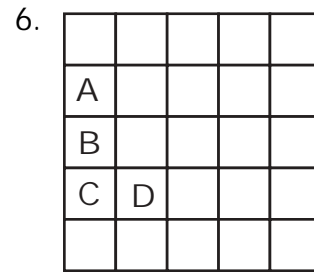
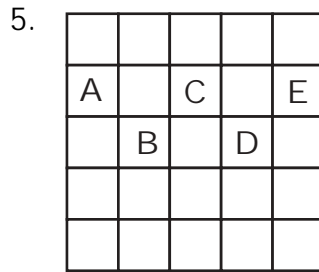
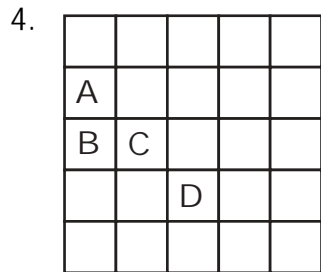
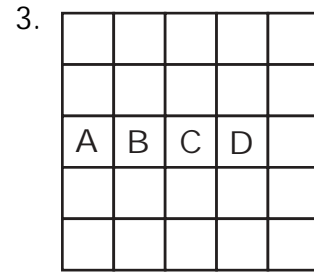
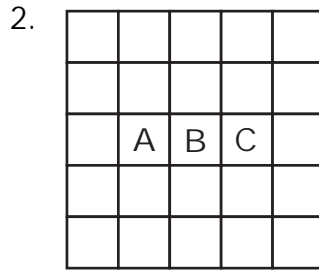
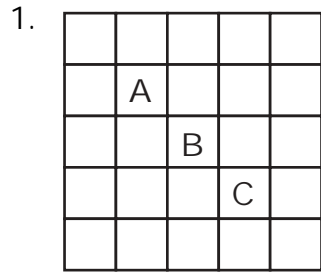
No further births

2nd Cycle

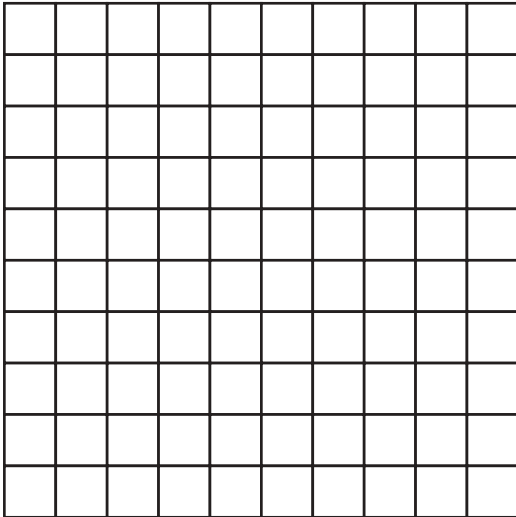
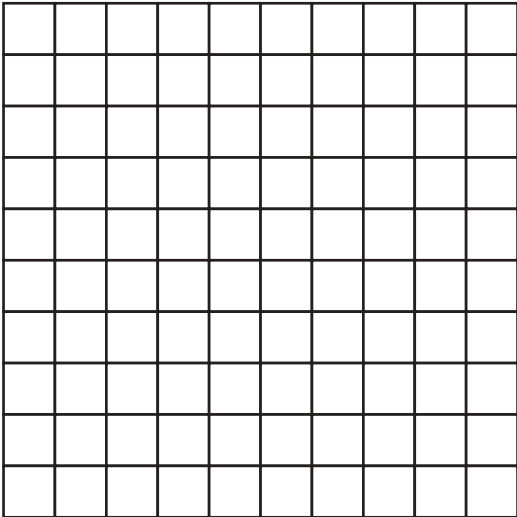
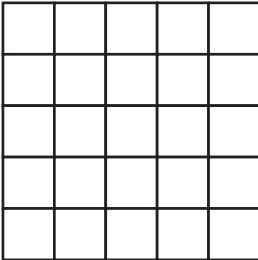
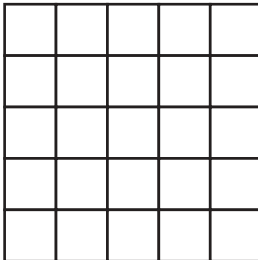
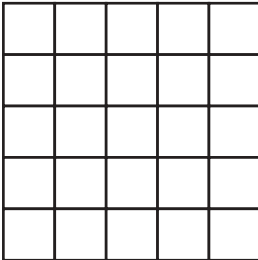
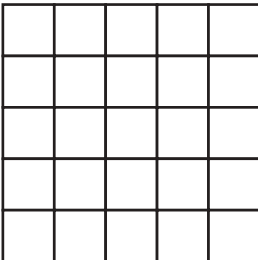
	B	C		
	A	D		

Colony is stable

Try the following:



13. Design a colony of at least four cells which will:
- become extinct
 - become stable
 - increase in the number of cells



Appendix II

Additional Resources

Print

Blocksma, Mary. *Necessary Numbers: An Everyday Guide to Sizes, Measures, and More*. San Diego, CA: Portable Press, 2002. ISBN 1-57145-866-2.

The Diagram Group. *The Little Giant Encyclopedia of Games for 1 or 2*. Sterling Publishing Company Inc. ISBN 0-8069-0981-1.

Fleisher, Paul. *Brain Food: Games That Make Kids Think*. Zephyr Press. ISBN 1-56976-072-1.

Kroner, Lou. *In the Balance: Algebra Logic Puzzles*. Creative Publications. Grades 4–6: ISBN 0-7622-0551-2
Grades 7–9: ISBN 0-7622-0552-0

Note: The Grades 4–6 book has some tough puzzles and is not necessarily just for Grades 4–6.

Nasht, Helen, and Dorothy Masterson. *Humorous Cryptograms*. Sterling Publishing Company Inc. ISBN 0-8069-3982-6.

Tuller, Dave, and Michael Rios. *Mensa Math and Logic Puzzles*. Sterling Publishing Company Inc. ISBN 0-8069-4199-5.

Internet

There are many sites on the Internet with problems and puzzles. When searching for problems and puzzles, use the words “mathematical games.”

As of February 2004, the following sites were available:

Fun Brain

<<http://www.funbrain.com>>

This site offers some interactive games. Some of the games could be adapted to pencil-and-paper games.

Puzzlemaker

<<http://www.puzzlemaker.com>>

This site allows teachers to create their own puzzles. One of the puzzle types is cryptograms. When using the site, be sure to print the answer with the puzzle as all puzzles are created new with each visit.

This Is Mega Mathematics

<<http://www.c3.lanl.gov/mega-math/>>

There are a variety of activities here. One of the activities involves map colouring. Another activity involves games with graphs.