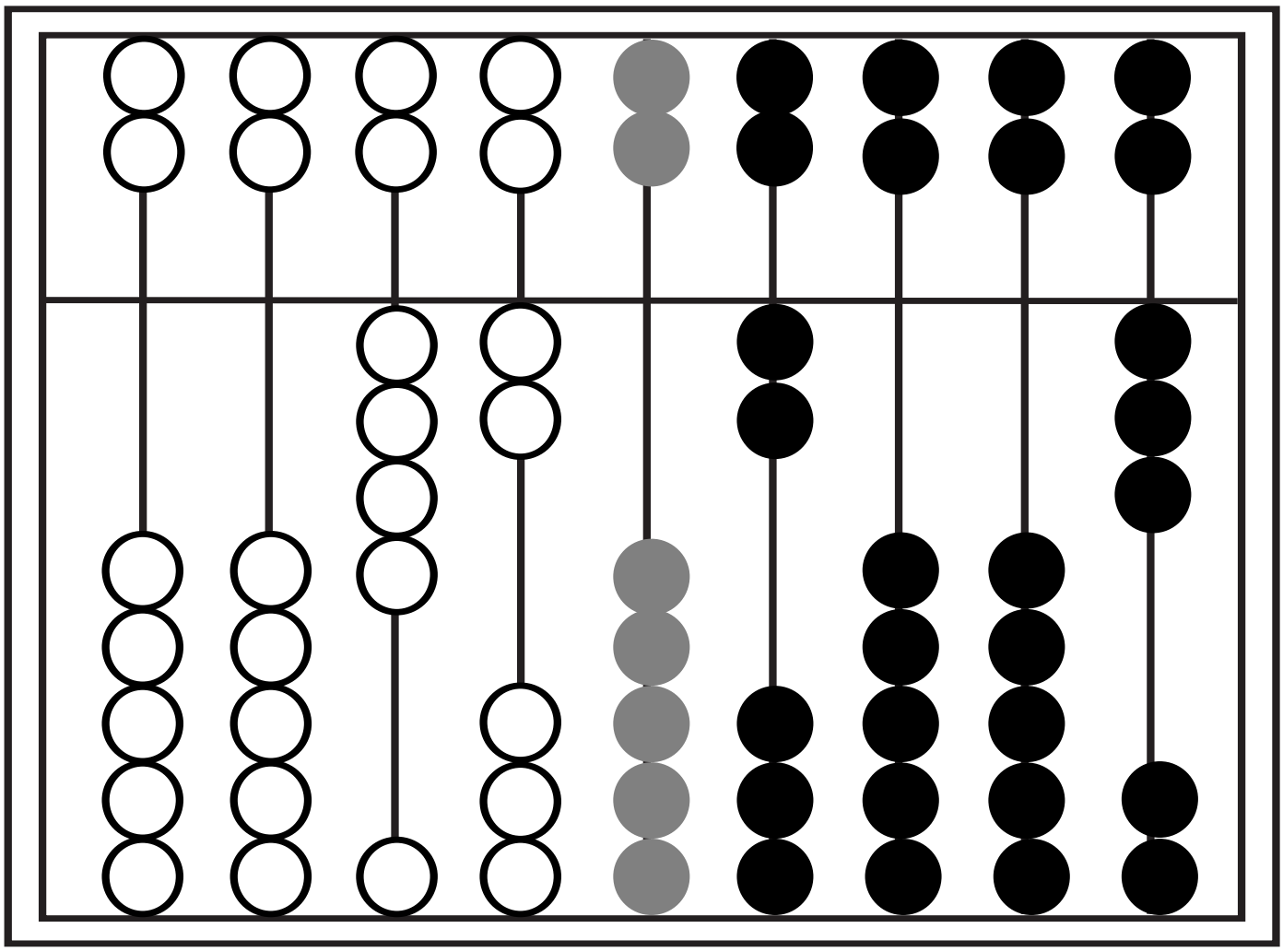
Abacus

Volume 42 2003



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Edited by Frances Schatz

ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATORS

▲ From the Editor's Desk

Hope you found the summer fun and relaxing while you prepared for this new school year. Since I prepare this journal before school ends in June, it is difficult to project one's mind to new classes and new school year in September.

At the OAME conference in May a number of speakers gave presentations or workshops on **Data Management and Probability**. For this issue I would like to focus on the session given by **Dr. Bev Marshman** and **Dr. Lorna Morrow** from the Centre for Education in Mathematics and Computing (CEMC) at the University of Waterloo.

CEMC members are teachers and professors from elementary and secondary schools and universities. It is a non-profit organization; materials are sold at cost. Visit CEMC and you'll feel the love of math all around you. CEMC members help promote interest in, enjoyment of, awareness of, and capability in mathematics.

Invitations to Mathematics, edited by Lorna Morrow and Bev Marshman, is a collection of activities or investigations for each of the strands in grades 4, 5 and 6. Lorna was a teacher with the North York Board until her retirement in 1994 and she continues to work as an independent math consultant. She has served OAME as council member, editor of *Abacus*, and president. As a writer and editor of curriculum materials, the publication I know best is the NCTM Yearbook 1998 *The Teaching and Learning of Algorithms in School Mathematics* edited by Lorna. Bev is a professor of Applied Mathematics at the University of Waterloo. Her special interest is developing support materials aimed at encouraging girls to study mathematics and science. She visits grade 4, 5 and 6 classrooms to test materials she develops and to work with students directly. Thank you Lorna and Bev for sharing activities from your workshop with *Abacus* readers.

Special Notes

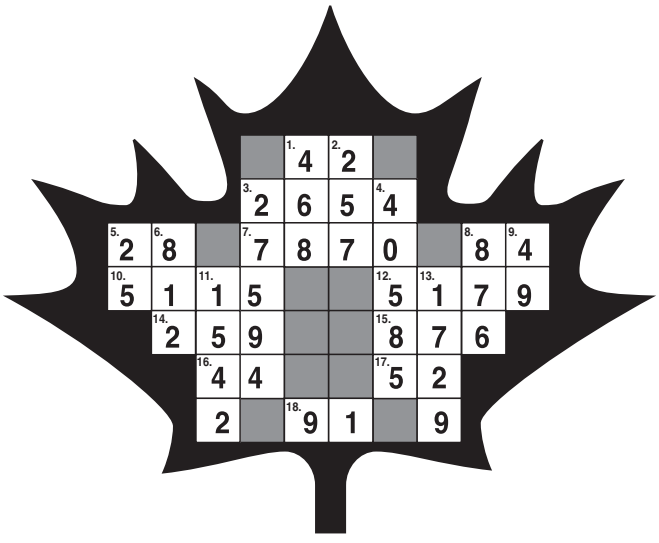
Visit *mathfrog.ca* a mathematics site of **Fun Resources** and **Online Games** for teachers, students and parents. This site attempts to assist Grades 4, 5 and 6 teachers integrate some technology into their mathematics classrooms. **Jim Schurter** is behind this project and he can be reached for more information at *schurter@math.uwaterloo.ca*

Visit 'Problems 4 the Web' at *cemc.uwaterloo.ca/p4w/root.html* for materials on-line, another project initiated by Bev Marshman. P4W includes teacher notes plus activity sheets.

To close this issue of *Abacus* and to help your students enjoy fall a little more, try out my **Maple Leaf NumPlex**. This puzzle is not connected to any particular strand; however, **Patterning and Algebra** is full of ideas for puzzles.

Frances Schatz

Maple Leaf NumPlex Solution



▲ Teacher Notes

From workshops by Dr. Lorna Morrow and Dr. Bev Marshman

Investigations in Probability: Let's Play Fair

The strand 'Data Management and Probability' for grade 5 expects students to demonstrate an understanding of probability concepts and connect them to real-life events such as games. **Fair Games** will help your students make that connection.

How to Make a Spinner

- Paste the template given on a piece of bristol/cardboard.
- Cut an arrow from bristol/cardboard and punch a hole in one end.
- Punch a hole in the centre of the template.
- Fasten the arrow to the template with a paper fastener. The connection should be tight enough so that the arrow doesn't wobble, but loose enough so that it spins freely.

Probability in Action: How Many Wolves

For this activity counters are needed. For example, two types of macaroni, 10 coloured and 50 - 100 uncoloured. You will also need a container from which to (draw) 'capture' groups of 10 pieces of macaroni. The macaroni pieces represent wolves.

Probability in Action: Lotteries

The strand 'Data Management and Probability' for grade 6 expects students to examine the concepts of possibility and probability. At this stage many students hear about raffles, contests and various lotteries and they should be encouraged (even though they legally cannot participate) to show an understanding of probability in the discussion of good and poor choices with convincing arguments. This activity will make your students think in a fun way.

Solutions and Notes

1. a) You need to know how many marbles of each colour are in the bag.

   b)You must draw 19 marbles. For example, you could draw all 6 of each of the first three colours before drawing one of the fourth colour.

   c) You must draw 24 marbles to be certain of getting one of each colour, because you could draw all 10 black, all 8 red, and all 5 green, before drawing a single orange.

   d) Answers will vary. Students should point out that you could draw 16 marbles by drawing 10 black and 6 red or 10 black, 5 green, and 1 orange, or 8 black and 8 red or any other combination of 16 marbles that does not contain all four colours.

2. (a) There could be 100 winners. There could not be more than 100 since there are only 100 'Y' bottles. However, a customer could buy a 'Y' bottle without buying bottles with the other 5 letters, and then there would be fewer than 100 winners.

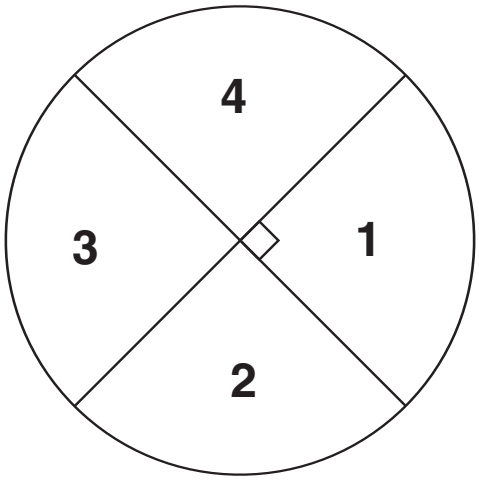
   (b) 30 million and 1. In order to be sure of winning, you would need to buy all the 'F' bottles, all the 'R' bottles, all the 'O' bottles, all the 'T" bottles, and all the 'H' bottles. Then you would need to buy only one of the 'Y' bottles. This is, of course, not likely to happen but it is the only way to be certain of winning.

Data Management: TV – Vice or Virtue

This short investigation demonstrates how information can be put into broken-line or bar graph format. One indicates a trend while the other compares different pieces of data.

▲ Fair Games

This is an activity for two people or two teams. One is ODD and one is EVEN.



In each turn, spin the spinner twice and add the two numbers. It doesn't matter who spins the spinner. One player or team wins if the sum is even; the other player or team wins if the sum is odd.

1 (a) Before you start the game tell whether or not you think this is a fair game. Why or why not?

Take ten turns and record your result in the chart below.

Turns	Sample	1	2	3	4	5	6	7	8	9	10
Sum of the two spins.	6										
Player Odd: Win or Lose?	L										
Player Even: Win or Lose?	W										

(b) Was your prediction accurate? Is this a fair game? Explain.

2 (a) Which of the spinners below would you choose if

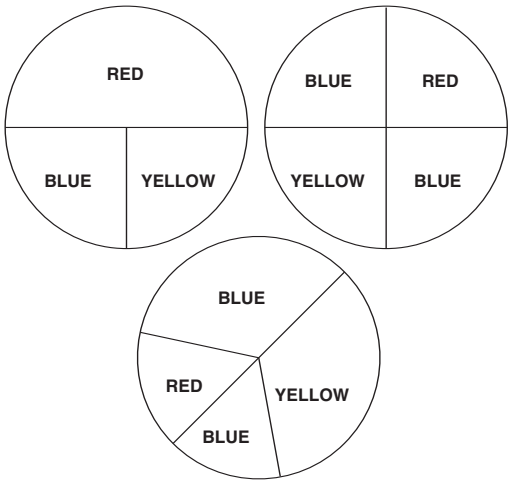
I) you need red to win; otherwise you lose

II) you need blue to win; otherwise you lose

III) you lose if you spin yellow; otherwise you win

IV) you win if you spin red or blue; otherwise you lose.

(b) Give reasons for your choice in each case.



3 (a) Several marbles are placed in bags as indicated below, and drawn one at a time. Tell which is more likely for each bag and give reasons for your answers.

I) drawing a red Ⓡ or drawing a blue Ⓑ

II) drawing a red Ⓡ or drawing a green Ⓖ

III) drawing a yellow Ⓨ or drawing a blue Ⓑ

Bag A ⓇⓇⓇⒷⒷⒷⒷⒷ

Bag B ⓇⓇⓇⒷⒷⒷⒷⒷⒼⒼ

Bag C ⓇⓇⓇⓇⒼⒼⒼⓎⓎⒷ

▲ How Many Wolves?

The macaroni pieces represent wolves. You are a wildlife biologist and you want to know how many wolves are in the forest (the container).

1. Reach into the container without looking, and 'capture' 10 'wolves'.
2. Replace each uncoloured piece with a coloured piece. The coloured pieces represent the wolves that you have tagged.
3. Mix all the wolves together. Now you are ready to 'sample' the population by capturing 10 more wolves.
4. Count the tagged wolves in this group (ie count the coloured ones), and record this in the chart for group 1.
5. Return group 1 to the container, and mix all the wolves together again.
6. Repeat steps 3, 4 and 5 three more times, and record the numbers of tagged wolves as groups 2, 3 and 4.
7. Calculate the average of the number of tagged wolves for groups 1 – 4.
8. You can now estimate the total population using the equation

$$\text{Total number of wolves} = \frac{100}{\text{Average number of tagged wolves per group}}$$

Group	Group Size	Number of coloured pieces (tagged wolves)
1	10	
2	10	
3	10	
4	10	
Average		



▲ Probability in Action: Lotteries

1. Suppose you have a bag of marbles in different colours, and you are asked "What is the least number of marbles you must draw to be certain you have at least one of each colour?"



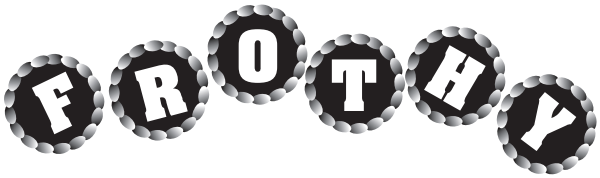
a) What information about the marbles do you need to answer this question?

b) If there are four colours, and six of each colour, what is the least number of marbles you must draw to be certain you have at least one of each colour?

c) If the bag contains 10 black marbles, 8 red marbles, 5 green marbles, and 2 orange marbles, what is the least number of marbles you must draw to be certain you have at least one of each colour?

d) Toby said the answer to c) was 16 marbles, because you might draw the 2 orange, the 5 green, and the 8 red before drawing any black marbles. Do you agree with Toby's answer? Why or why not?

2. The *Frothy Cola Company* decided to run a contest using letters under the bottle caps of their new Licorice flavoured cola. They put the letters F, R, O, T, H, and Y under the caps, one letter per cap. Any customer who found all six letters won 6 cases of Frothy.



The president of the company, Mr. Froth, wanted some idea of the probable number of winners, so he asked his advertising manager, Ms. Cola, for an estimate. She told him the number of bottles of Frothy Licorice Cola a person would have to buy to be absolutely sure of winning.

Mr. Froth was surprised because he thought the number would be '6' – one with the letter 'F', one with the letter 'R' and so on. But Ms. Cola knew something about frequencies and probabilities, so she told him that

- 12 million bottles had an 'F' under the lid
- 10 million bottles had an 'R' under the lid
- 5 million bottles had an 'O' under the lid
- 2 million bottles had a 'T' under the lid
- 1 million bottles had an 'H' under the lid, but only
- 100 bottles had a 'Y' under the lid.

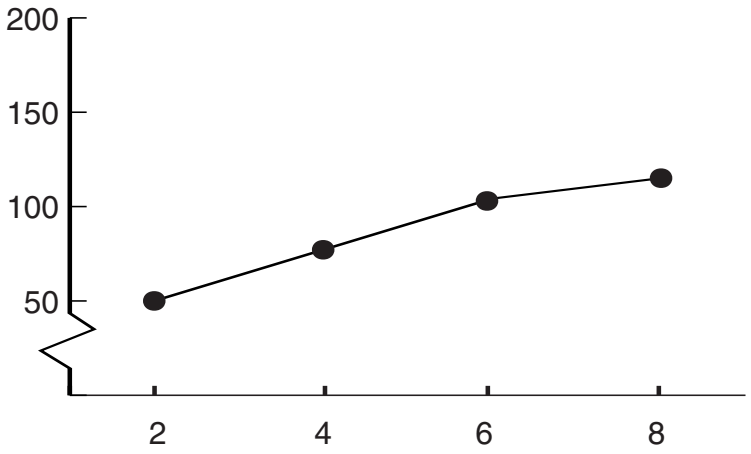


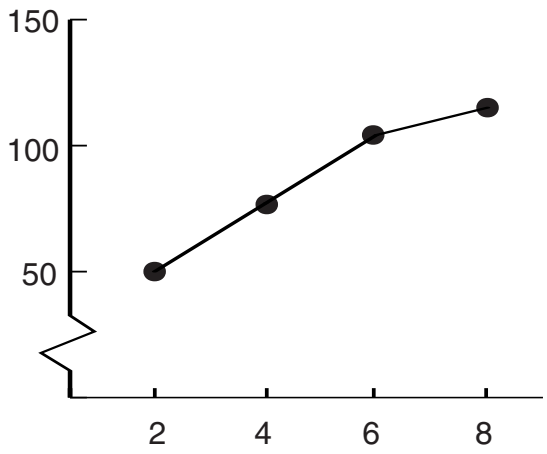
a) If all the bottles were purchased during the contest, how many winners could there be? Would there necessarily be that many winners? Why or why not?

b) What number had Ms. Cola given Mr. Frothy? That is, how many bottles would you have to buy to be certain of winning?

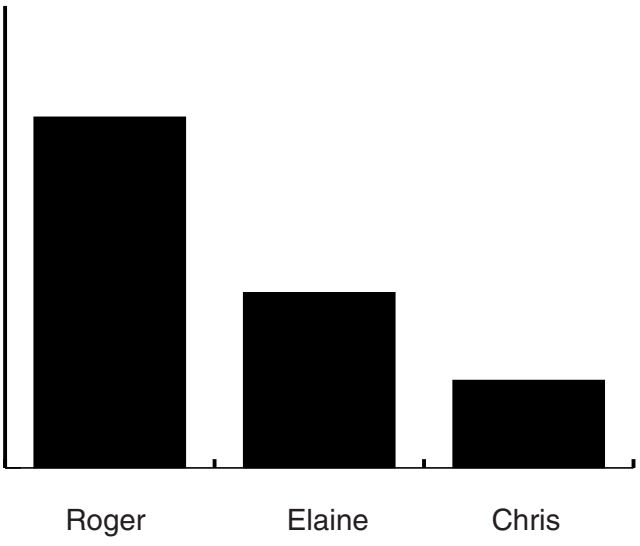
▲ TV – Vice or Virtue?

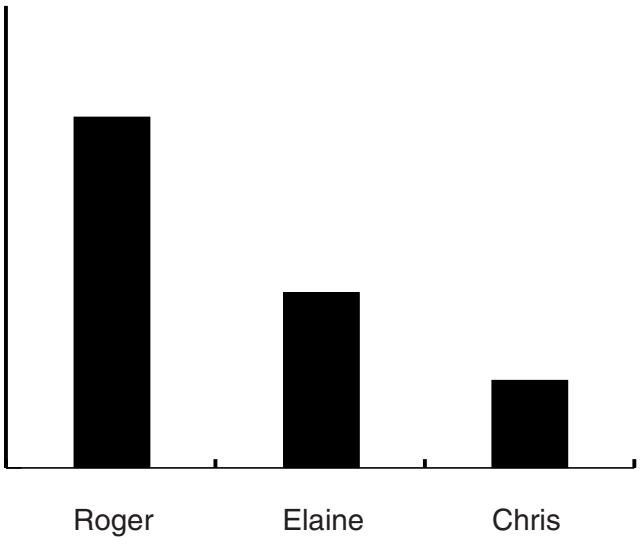
1) The sponsors of the *Blimpsons* kept track of their viewing audience for the first few months of the new show. The results are shown in Graph A. The star of the show wanted to keep the show on the air so he redrew the graph (Graph B) and said the graph showed a rapidly growing audience. How did he make it appear as if the audience were growing faster? Was it really increasing faster? Explain.





2) Roger, Elaine, and Chris all enjoyed eating popcorn while watching TV movies. Roger ate twice as much as Elaine, and four times as much as Chris. Which graph below shows this accurately? How is the other graph distorted? What does it seem to show?





▲ Maple Leaf NumPlex *by Frances Schatz*

Across

1. Factors of this number are 2, 3, and 7
3. Two times (120 x 11 + 7)
5. A perfect number
7. The number formed by the first two digits is eight more than the number formed by the last two digits.
8. The next number in the pattern 42, 56, 70, …. is _____.
10. A palindrome
12. Sixty-four more than 10 Across
14. 2 more than 2 Down
15. A multiple of 73
16. Divisible by 11.
17. The number of weeks in a year.
18. The product of 19 and this number is 13 Down.

Down

1. A multiple of 12.
2. $2^8 + 1$
3. 73 x 63 x 6
4. Five times (11 x 18 x 41 – 1)
5. Number of cents in a quarter
6. 29 times 5 Across
8. Consecutive digits in reverse order
9. A perfect square
11. Six times 2 Down
13. This number is divisible by the sum of its own digits.

