COLLABORATIVE INVESTIGATION

A Perpetual Calendar Algorithm

In this chapter we examined some alternative algorithms for arithmetic computations. Algorithms appear in various places in mathematics and computer science, and in each case give us a specified method of carrying out a procedure that produces a desired result. The algorithm that follows allows us to find the day of the week on which a particular date occurred or will occur.

In applying the algorithm, you will need to know whether a particular year is a leap year. In general, if a year is divisible (evenly) by 4, it is a leap year. However, there are exceptions. Century years, such as 1800 and 1900, are not leap years, despite the fact that they are divisible by 4. Furthermore, as an exception to the exception, a century year that is divisible by 400 (such as the year 2000) is a leap year.

In groups of three to five students, read the algorithm and then work the Topics for Discussion.

THE ALGORITHM

This algorithm requires several *key numbers*. Key numbers for the month, day, and century are determined by the following tables.

Month	Key
January	1 (0 if a leap year)
February	4 (3 if a leap year)
March	4
April	0
May	2
June	5
July	0
August	3
September	6
October	1
November	4
December	6

Day	Key
Saturday	0
Sunday	1
Monday	2
Tuesday	3
Wednesday	4
Thursday	5
Friday	6

Century	Key
1700s	4
1800s	2
1900s	0
2000s	6

The algorithm works as follows. (We use October 12, 1949, as an example.)

		Example
Step 1:	Obtain the following five numbers.	
	1. The number formed by the last two digits of the year	49
	2. The number in Step 1, divided by 4, with the remainder ignored	12
	3. The month key (1 for October in our example)	1
	4. The day of the month (12 for October 12)	12
	5. The century key (0 for the 1900s)	0
Step 2:	Add these five numbers.	74
Step 3:	Divide the sum by 7, and retain the remainder. ($74/7 = 10$, with remainder 4)	
Step 4:	Find this remainder in the day key table. (The number 4 implies that October 12, 1949 was a Wednesday.)	

TOPICS FOR DISCUSSION

1. Have each person in the group determine the day of the week on which he or she was born.

(continued)

2. Among the group members, discuss whether the following poem applies. (This is all in good fun, of course.)

> Monday's child is fair of face,
> Tuesday's child is full of grace.
> Wednesday's child is full of woe,
> Thursday's child has far to go.
> Friday's child is loving and giving,
> Saturday's child works hard for a living.
> But the child that is born on the Sabbath
> day is bonny and good, happy and gay.

3. Determine the day of the week on which the following important historical events occurred.

(a) December 7, 1941 (the bombing of Pearl Harbor)

(b) November 22, 1963 (assassination of John F. Kennedy)

(c) July 4, 1976 (bicentennial of the United States)

(d) January 1, 2000 (the "dreaded" Y2K day)

(e) September 11, 2001 (the terrorist attacks on the United States)