THE STATISTICS TEACHER NETWORK

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ICOTS 3

During the week of August 19-24, 1990, nearly 600 participants representing over 30 countries descended upon the quiet town of Dunedin, New Zealand to attend the Third International Conference on Teaching Statistics. Held on the campus of the University of Otago, the Conference consisted of a broad program that dealt with key issues in the teaching of statistics at all levels, kindergarten through graduate school, and in the promoting of the importance of statistical ideas among the general public. From the presentations and discussions, it is clear that what topics should be taught and how topics should be taught are important issues not only for statistics and mathematics programs, but also for programs in the biological sciences, physical sciences, engineering, social sciences, business and other disciplines that must deal with data and uncertainty.

The tone of the Conference was set by Dr. Geoff Jowett in his opening speech on expanding statistical education. Now retired, Dr. Jowett reminded the audience of how fortunate we are to have students coming to us in droves and to have modern computing equipment available for classroom use. This is a far cry from the "old days" and present-day teachers should make the most of these opportunities. He struck a responsive cord by stating his long-held belief that statistics courses should be scheduled with as many laboratory hours as physics and chemistry courses, and gave some examples of activities that could be done in such laboratories (bring a tire pump and some balloons and experiment on the number of pump strokes it takes to break balloons of different brands). Effective teaching of statistics requires practical experimentation, according to Dr. Jowett. Academics must become involved in statistical education at the school level, and such involvement should be a recognized part of their academic duties. They must help develop a logical, self-contained syllabus and influence examinations. (Dr. Jowett was instrumental in developing the national curriculum in statistics now a part of the New Zealand educational system.)

At the school level, a new spirit of teaching mathematics is evolving around the world. Data analysis and probability are becoming key components of educational programs that motivate and illustrate mathematical concepts by use of applications to the real world of the students. Calculators and computers are a necessary part of this approach to teaching mathematics, and a number of sessions dealt with their use in the classroom. Mathematics

is being viewed more as critical thinking than as memorizing algorithms. Nation-wide project and poster competitions had their start in Japan and the United Kingdom but are now being developed in many more countries.

At the undergraduate level, the emphasis is also upon getting students involved with real applications of statistics through designing experiments and analyzing data. Most speakers agreed that students should be taught the practical uses of statistics rather than the theory, and hands-on activities are essential. Even at the graduate level, statistics majors should be given more practical experience at designing experiments, analyzing data, and consulting since that is what most jobs require.

Sessions on statistical literacy in the community emphasized the fact that all teachers of statistics have an important role to play as interpreters of statistical information for the general public. Newspapers should not get by with shoddy writing on quantitative issues, advertisers should be required to use data correctly, and government officials should be asked about the factual basis of their statements. On the positive side, more could be made of the global interest in sports and the importance of common decisions in areas like insurance to teach the public about statistics and statisticians, and perhaps to offer valuable service.

Within the push for more data analysis in statistics that was clearly in evidence, some speakers did call out a warning that probability should not and cannot be eliminated. Probability is, after all, the basis for statistical decisions and is the only logical mechanism students can be taught for making decisions under uncertainty. It cannot be eliminated just because it is difficult, but it can be taught in a practical context.

Interest in statistics is increasing throughout the world, and many have made improvements in content of courses and in teaching methods since ICOTS 2. It is not clear, however, that the "blessings" of students in droves and modern computers, as mentioned by Dr. Jowett, are universally recognized as blessings. Although many good suggestions were presented on how to handle the surging interest in statistics and how to use computers effectively in the process, a few more ICOTS sessions may come and go before statistics fits comfortably in school and university curricula, as well as in the minds of the public.

The Statistical Education Committee of the International Statistical Institute (ISI) is considering the development of a proposal to form an international society on statistical education that would be associated with ISI but give more attention and visibility to educational issues. Anyone interested in supporting such a venture may contact David Vere-Jones, Institute of Statistics and Operations Research, Victoria University, P.O. Box 600, Wellington, New Zealand.

The rain in New Zealand did not dampen the enthusiasm of the participants, nor did it keep them from touring the harbors and mountains. (It may have cut down on tennis and golf.) The Conference was well-organized and enjoyed by all. However, if warmer and dryer air is your forte, then plan to attend ICOTS 4 in 1994 in Morocco!

– – Richard L. Scheaffer

Wings to the Future in Wichita

The Southwestern Regional Conference of the NCTM will be held in Wichita, Kansas on November 1-3, 1990. The theme of the conference is Mathematics: Wings to the Future. Two and one-half days of workshops and sessions including over 270 speakers are scheduled for this meeting. There are 17 sessions and workshops which focus on statistics and probability at all grade levels from kindergarten through college.

A special session on Statistical Applications & Training in Industry will be presented by Denise Johnston, statistician at Boeing Wichita. A sample of other titles includes: Middle School Statistics Made Fun; Statistics? Probability? For Kids? You Bet!; Staggering Statistics to Stimulate Students; Casinos, Drug Testing, and Booze: Lessons from the Public's Mathematics; and Statistics + Algebra = Applied Mathematics; A New Algebra Sequence.

Special evening activities with a southwestern Wichita flavor are planned for conference participants. For details of the program and housing information, consult the NCTM program booklet for the Wichita Conference.

– – Margaret Butler

Review of DATA ANALYSIS

This course booklet and software (for IBM PC or compatible machine with 512K) was written by the Department of Mathematics and Computer Science at the North Carolina School of Science and Mathematics in 1987. It is available from the National Council of Teachers of Mathematics, 1906 Association Dr., Reston, VA 22091, for $10. ISBN 0-87353-258-9.

The primary goal of *Data Analysis* "is to provide students with an applications-oriented, investigative mathematics course in which students are provided keys to understanding the technological world in which they live." This courseware and its accompanying software succeed admirably in laying the foundations for accomplishing this goal.

Three chapters provide the beginning data analysis student with clear concepts and techniques relating to the organization of numerical information. The first of these deals with data of a single variable and includes standard descriptive statistics and graphical representations of data. Exploratory data analysis methods such as stem-and-leaf and box-and-whisker plots as well as the standard scatter grams are employed to display data.

The second and third chapters help the student learn to analyze and represent data given as sets of ordered pairs. Creating appropriate graphical models through linearization techniques and testing of "fit" using residuals are the main thrusts in these sections. Fitting a line to data is approached through both the median-median and least squares methods. The strengths and weaknesses of each is investigated.

Although the material is intended for use primarily in grades 11-14, it is presented in a manner which makes it readily accessible to younger students. For students with a good foundation in algebra, the first and second chapters should be readily accessible. Knowledge of logarithmic, exponential and power functions is needed for chapter three.

All data sets are take from real applications, are well chosen and are interesting. Exercise sets check not only for knowledge level comprehension, but also for deeper understanding of relationships among topics.

> "Discuss the following statement: Three-fourths of the students in this class are above the class average." (page 12)

> "According to the principle of least squares, can the sum of squared residuals be zero? If so, what would that mean about the fit?" (page 75)

The chance of students being overwhelmed by the concepts in the text is minimized by the clear, intuitive explanations and the inclusion of interesting historical references.

The answers to all classroom practice, regular, and supplemental exercise sets are included as chapter 4.

The last chapter of the booklet is a users' guide for the software. It is complete and easy to follow. The program included provides computer support for all activities in the text. Applying a least squares fit to re-expressed data can be accomplished directly from the menu. To apply the median-median fit, data must first be re-expressed through a different screen. In general, the menus are clear. It is necessary to recycle through several screens in order to change options.

Two hints:

1) As the users' guide states, it is necessary to remove the Analysis disk and insert a data disk to store data since the program has no way to address a second drive.

2) The "shift" and "printscreen" keys can be depressed together to print what is on the screen. Depending on your printer, however, graphics screens may not print. On some Disk Operating Systems (DOS) typing "graphics" at the prompt before typing "analysis" (which calls up the program) will make it possible to print the graphics as well as the text screens.

– – Sue Eddins

Review of BASIC STATISTICS

Basic Statistics, Tales of Distributions (4th ed.) by Chris Spatz and James O. Johnston, Brooks/Cole Publishing Co., 1989.

The authors of this text have written in a "chatty" style designed to put their readers at ease. Many anecdotes, both historical and humorous, have been included. The authors' intent is to make the content more human and less intimidating. At first, this style was appealing. As I continued to read through the book, I found it getting old; what might be a good anecdote when told personally did

might be a good anecdote when told personally did not always come across well on the written page. It was also difficult to skim a passage for the "meat," even with the assistance of bold-face or italic type.

Major topics in the book are the standard topics found in most introductory statistics books – organization of data, graphic presentations, central tendency, dispersion, correlation and regression, normal and sampling distributions, hypothesis testing, t-tests, analysis of variance, and a chapter each on chi-square distributions and nonparametric statistics. More attention is given to ANOVA, including factorial design, than is found in many introductory statistics books. Some important content is noticeably absent or given minimal attention. Binomial distributions receive only two pages; how to determine an appropriate sample size to reduce error to a desired margin is not discussed at all. In addition, modern techniques of data analysis such as box-and-whisker plots, stem and leaf analyses, and median line of fit were nowhere to be found.

Technology plays a very minor role in the text. Calculator usage is referred to occasionally in footnotes. There is no mention at all of the value of spreadsheets or the use of commercial statistical packages. Emphasis is on "grinding it all out by hand."

Throughout the book, illustrations are plentiful. This is especially true of distributions, the unifying theme of the book. Often, however, truly important content that should stand out in some way (formulas, examples of problems) is embedded in the narrative in such a way that it is hard to follow. (An example of this, involving z-scores, is on page 108.)

The explanation of some important topics leaves much to be desired. The introduction of z-scores is done very casually before the normal curve, which does not seem logical to me. They are discussed again later, but few problems are given for practice. Illustrations included with discussion of confidence intervals seem inadequate to represent the concept or help students understand it. Steps for hypothesis testing are given, but the reader is not given illustrations of how these steps would look in an actual test.

There are some good pedagogical aids. The how to study tips, early in the book, and the objectives for each chapter are helpful. Problem sets, however, seem inadequate to give students the practice they need to become adept at using and interpreting data. Overall I did not find the book easy to read or easy to follow.

– – Beverly Nichols

QUEUE: Intellectual Software

Available from Queue, 338 Commerce Dr., Fairfield, CT 06430

Descriptive Statistics: This three-disk package is designed to supplement an introductory statistics course. On each of the first two disks there is a menu allowing the user to start a tutorial, take a 10-question multiple choice test, or exit; the third disk is a statistics laboratory. One tutorial disk presents the measures of central tendency and the other covers measures of variability. The format of the tutorial consists of a page of text, usually a definition or rule, followed by a multiple-choice item; the user is not allowed to continue to the next page until the item is answered correctly. There is an opportunity to review previous pages, view the Glossary or return to the menu throughout the tutorial. The number correct out of the total number of test questions answered is displayed while taking a test and it is possible to exit a test and start a new test or return to the menu at any point during the test. The statistics laboratory disk allows input of a maximum of 20 three-digit positive integers and will then display statistics and a histogram for the data.

The tutorials move very slowly and use the "cookbook" approach. There is too much text on many of the pages and each question can usually be answered easily after reading only the previous page thus encouraging memorization without understanding. There is feedback after the selection of each answer but there may not be sufficient time allowed to read it when a question is answered correctly. Several of the questions from the tutorial are included in the 10-question multiple-choice test and again in any retest the student may take. The statistics laboratory disk is easy to use but is very limited in its application. Graphing capabilities for the histogram and statistics would enhance this package. This program would not add anything to a regular classroom presentation.

– – Mary Hebert

USING SPREADSHEETS TO ADVANTAGE IN INTRODUCTORY PROBABILITY

Probability and statistics are worthy of study in the middle grades, but are given minimal attention. There are reasons, of course. The topics are often at the end of the text. Teacher training has been weak in those areas, so instructors do not rush to get to those topics, favoring instead to drill on the arithmetic algorithms with which they are familiar. Those who do venture into experiments of chance are limited by the inadequate prerequisite mathematics skills of their students, disallowing much a priori study, and problems with collecting accurate and sufficient data to draw good after-the-fact conclusions.

This article focuses on the last problem and suggests one way to facilitate the study of probability and statistics in the middle grades–with the use of a computerized spreadsheet which offers a random number function as an option.[1]

We will begin this discussion at a point where it is assumed the students–6th graders in our case–have a good working knowledge of the spreadsheet's mechanics in general, and the random number function specifically.

The usual first study involves the flipping of a coin. Let's move immediately to the flipping of two coins and the relative frequencies of the HH, TT and mixed cases. Asking 6th graders how many times out of 300 trials you might expect both heads, both tails or one of each often elicits the response, "100 each."

At this point we can test that theory by breaking the class into pairs of students and having them flip two coins 300 times. Coins roll away, record keepers lose interest, and time escapes fast. There may or may not be opportunity for proper analysis of the results.

[1] We use Better Working Spreadsheet from Spinnaker Software on Apple IIe's and IIgs's. The program is inexpensive and easy to use for young students. The program's RND function is Applesoft BASIC's random number function. While it does not meet the purist's approval, it is at least as valid as having students flip imperfect coins and roll imperfect dice imperfectly.

The following spreadsheet can either be created as a class project, or can be provided by the instructor. We choose to create it together as an early probability exercise.

```
  A 0          TWO COINS
?

A                    TWO COINS
B
C          1 = HEADS, 0 = TAILS
D
E          COIN 1-->        0
F          COIN 2-->        0
G
H          # TRIALS>       24
I
J          H & H--->        5
K          T & T--->        7
L          # MIXED->       12
M
N
O
P
Q
R
S
T
      0         1         2         3
```

Spreadsheets allow three kinds of entries in which to present information–labels, values and functions. In the TWO COINS example, everything on row A, row C and in column 1 is a label. Labels are words which document the data. Values are typically, but not always, numbers supplied by the user from the keyboard. In this example there are no values. Functions call for the mathematical operations which make a spreadsheet the powerful tool that it is.

All the functions here are found in column 2. The responsibility of cells E2 and F2 is to generate heads or tails. The function INT(2*RND(1)) found there does the job, RND(1) producing a random decimal between 0 and 1, the factor of 2 doubling that range and INT, the greatest integer function, yielding a 0 (which is arbitrarily interpreted as a tail) or a 1 (a head).

The function H2+1 keeps track of the number of tosses by having cell H2 add one to itself each time the sheet is recalculated. Conditionals monitor the occurrence of two heads or two tails. In cell J2 is the function IF(E2 = 1 AND F2 = 1, J2+1, J2). Interpret this as "IF E2 contains a 1 (a head) and at the same time F2 contains a 1 (a head), then add 1 to the J2 counter, otherwise leave J2 alone." Cell K2 contains a similar function, but of course checks for 0's in E2 and F2.

Finally, the number of mixed results can be cal-

culated by subtracting the pure heads and pure tails from the number of trials. Hence, L2 contains H2-(J2+K2).

If each of 15 computers in a lab now calculates the sheet, say 200 times, we have 3,000 trials in a couple of minutes. It is soon observed by our young students that the mixed tosses accumulate at a rate about twice either the pure heads or pure tails.

At this point, the spreadsheet has done its job. Much data has been accumulated conveniently; now it is up to the teacher and the students to bring an explanation to the data. (The importance of *some* experimentation with real coins if you are working with younger children must be emphasized. Sixth graders need the reality base from which to interpret the abstractions of the spreadsheet results.)

Moving on, flipping eight coins at once and determining theoretical probabilities of exactly one head, exactly two heads, at least five heads, etc., are unreasonable expectations for young students. The physical experimentation is cumbersome, and the necessary mathematical understandings are not in place. But, despite those obvious drawbacks the use of a spreadsheet in this case promotes at least a strong *awareness* of the dynamics of the coins and promotes observation skills and discussion. Establishing formal probabilities can wait until a later time.

Here is the sheet that performs that binomial experiment:

```
  K 0          BIN.8.COINS
?

 K          1st coin:          1
 L          2nd coin:          0
 M          3rd coin:          1
 N          4th coin:          1
 O          5th coin:          1
 P          6th coin:          1
 Q          7th coin:          1
 R          8th coin:          0
 S
 T          Cumulative totals:
 U            8H, 0T:--->              0
 V            7H, 1T:--->              4
 W            6H, 2T:--->              6
 X            5H, 3T:--->             11
 Y            4H, 4T:--->             18
 Z            3H, 5T:--->             18
AA            2H, 6T:--->              7
AB            1H, 7T:--->              1
AC            0H, 8T:--->              0
AD
       0          1          2          3
```

The eight coins are being tossed as described above. The function in cell U3 is testing the sum of K2 through R2: (IF SUM(K2.R2) = 8, U3+1, U3). Cells below U3 test for sums of 7, 6 and so forth.

While 6th graders will never discuss the results in terms of binomial distributions and combinations, they most definitely can see trends, question those trends and answer to their own satisfaction why, for instance, four heads and four tails are so much more likely than all eight heads.

Ask 6th graders how likely it is that in a group of ten people there is at least one birthday match and you will get responses of all sorts! Here again, the mathematics needed to deal rigorously with that problem is not available. Also here again though, the spreadsheet can bring a topic from a secondary level down to theirs and provide them a feeling for the likelihoods. Good quality informal discussions of the data are of the utmost value here.

```
A        A BIRTHDAY PROBLEM
B        ~~~~~~~~~~~~~~~~~~
C  Ten (10) 'random' people enter a
D  room.  What is the probability of at
E  least two matching birthdays?
F
G                              Match w/    Total
H  Person #   Birthday         below?      trials
I  --------   --------         --------        145
J         1          272                0
K         2          286                0  Total
L         3          104                1  success
M         4           38                0       14
N         5          147                0
O         6          346                0  Prob'ty
P         7          104                0     of
Q         8          288                0  success
R         9          184                0 .09655172
S        10          156          <BLANK>
T
          1          2          3          4
```

In this example we skip the leap year case, admitting the oversimplification. Column 2 generates random numbers 1 through 365 for each of our ten people. Column 3, in each case, asks whether the birthday to the left matches one or more of those below. Cell J3, as an example, contains IF(J2=K2 OR J2=L2 OR J2=M2 ORJ2=N2 OR J2=O2 OR J2=P2 OR J2=Q2 OR J2=R2 OR J2=S2, J3+1,J3). Cell R3, of course, would contain a briefer function: IF(R2=S2,R3+1,R3).

Writing this spreadsheet is not required for our 6th graders. It is provided to them. A classroom discussion of how it was built, however, is very useful and gives the students a feeling for its validity and the relatively low probability revealed.

One last example, one which treats a derivation of pi, is appropriate several grades later and may be of interest to the reader as a little more off-beat.

Imagine a square dart board, two units on a side, and a unit circle inscribed in it. You throw darts at this board and it is understood that you never miss. You are always within the square, but otherwise you have no skill and your darts fall randomly within the square. By chance, then, most of your darts will be within the circle, too.

One can reason pi's approximation as follows:

$$\frac{\text{Area of circle}}{\text{Area of square}} \rightarrow \frac{\text{No. of darts in circle}}{\text{No. of darts in square}}$$

$$\frac{\text{Pi} * 1^2}{2^2} \rightarrow \frac{\text{No. of darts in circle}}{\text{No. of darts in square}}$$

$$\text{Pi} \rightarrow 4 * \left(\frac{\text{No. of darts in circle}}{\text{No. of darts in square}}\right)$$

Here is the spreadsheet which approximates pi in this way:

```
  A 0          PI GENERATOR
?
A                    PI GENERATOR
B                    ------------
C
D              X-COORDINATE-->    .23129340
E              Y-COORDINATE-->    -.7250509
F
G              DIST TO ORIGIN--> .76104895
H
I              # DARTS IN CIRCLE>        60
J              # DARTS IN SQUARE>        71
K
L              PI APPROXIMATION->3.3802816
M
N
O
P
Q
R
S
T
     0         1         2         3
```

After 71 dart tosses, 60 have landed in the circle. Cells D3 and E3 produce random decimals in the -1 to 1 range, representing the throwing of the dart onto the two-by-two board. Cell G3 calculates the distance of the dart from the origin (Pythagoras) and cell I3 increments only when cell G3 contains a result less than one, the radius of the circle. Pi is calculated on row L by way of a function that takes the ratio of darts in the circle to darts in the square and multiplies by 4 (see above).

The use of a computerized spreadsheet with a random number generator available has possibilities in the study of chance happenings of all sorts and at all levels. These examples are all created with very simple programs. With the exception of the last example, all can be dealt with in the middle grades. Given older students, more sophisticated software and the willingness on the part of the teacher to tackle old problems in new ways, the study of probability and statistics can take on a brand new excitement and meaning.

-- John C. Russell

PROBABILITY I: COUNTING TECHNIQUES

Mathematics for Modern Living (M-26) Videotape Series, 1979. Time: 28 minutes. Magna Systems, W. Countyline 95, Barrington, IL 60010.

Beginning with examples of the pervasiveness of probability in daily life, the narrator proceeds to recount the colorful history of probability. The introduction to the numerical aspects of probability originates with the sample space associated with rolling a pair of dice. The concepts of probability, sample space, and equally likely are defined. The Multiplication Rule and simple permutations are discussed along with an explanation of factorial notation.

The videotape is not mathematically oppressive. Most middle school students should be able to follow the development of the concepts. The hand gestures of the narrator are distracting, however. The nine-page study guide provides an overview of the tape, a pretest, probability activities, a glossary, and problems for further investigation.

-- Pamela Coffield

HANDS ON STATISTICS, EXPLORATION WITH A MICROCOMPUTER

by J. Weissglass, N. Thies, and W. Finzer, Wadsworth Publishing Company, 1986.

The text comes with a single microcomputer diskette written either for IBM or APPLE microcomputers containing 15 programs — Flip Coins, Histograms, Draw Tickets, Sum Tickets, Binomial, Normal, Rescale, Means Confidence, Proportions Confidence, Sample Mean, Test Mean, Test P, Test Two Means, Test Two P, and Linear Regression. There is a help screen, but it is limited to a discussion of cursor movement. The text contains individual program descriptions in its appendix and numerous examples. Various options are selected within a program by cursor movement. Most programs present an excellent graphics display or a table display, switching from one to the other with a simple cursor movement followed by Enter. For example, the Binomial program prints either a table of binomial probabilities or a frequency histogram of the probabilities. The program may also be used in a simulation mode and in this mode one may see the empirical proportions printed out alongside the theoretical probabilities.

The program diskette contains numerous data files which may be used with specified programs. Several of the programs allow you to compose your own data set and to save it to diskette for later use. The actual data input format allowed is quite restrictive, and often must be approximated. For example, the program regression allows you to select ordered pairs of data from the screen by cursor movement on the screen itself. This turns out to force approximation of points and is a relatively slow and tedious procedure. Unless your data points are ordered in some nice manner, you will find that a large amount of cursor movement (itself slow) is necessary.

The primary strength of the package is the output display, the ability to simulate certain probability models based on Bernoulli trials, to sample with replacement from given finite populations, to simulate the central limit theorem, to simulate the construction of confidence intervals and to plot scatterplots with an overlay of the least squares regression line. For most of the programs the textbook uses a workbook approach to lead the student to a "discovery" of some general results.

The textbook often suggests that the student consult other textbooks to obtain a better understanding of the statistics being discussed. The authors often leave much to be desired in their definitions and explanations. For example on page 102 the authors define "the expected value of a random process". No mention was ever made of random variables and their probability distributions. On page 280 is the following statement: "You can also think of the regression line as the straight line that is 'closest' to all the points (the sum of all the distances from the points to the line is as small as possible)." One certainly hopes that the authors realize that the sum is theoretically zero for many different choices of 'fitted' lines. Many other examples could be given.

I believe that the primary weakness of the diskette is that it cannot be used to do real statistics. For example one cannot use the histogram program with real data that might be gathered by the student without first putting it in histogram form and then inputting it with the write capabilities of the histogram program. Actually "histogram" to these authors means a frequency count of each data point although counts may be grouped. No mention in the text is made of Exploratory Data Analysis which in this reviewer's estimation should be the foundation of any introductory statistics course.

I believe that the primary weakness of the text is its imprecision in the use of the language of statistics and its omission of many important statistical concepts.

In summary, I believe these materials when used by a skillful, knowledgeable teacher could be a useful supplement to a first course in statistics. The programs appear to be well done and are easy to use. However there are many good student versions of well known statistical packages, available at relatively low cost and quite user friendly, that would essentially allow one to duplicate the author's work but provide much more in the way of standard statistical analysis and procedures.

No attempt was made by this reviewer to determine the validity of the various computational procedures used by the authors.

-- Howard A. Bird

MIDDLE GRADE MATHEMATICS PROJECT – PROBABILITY

by Phillips, Lappan, Winter, & Fitzgerald
Published by Addison-Wesley, 1986

"*The Middle Grades Mathematics Project* is a series of teacher source books with unique teaching guides and blackline masters designed to help teachers develop student's problem-solving skills via activity-oriented mathematics. The materials are appropriate for a broad range of grade levels and student abilities."

The preceding quote appears on the back cover of the book and is a fairly accurate summary. This particular book in the series deals with probability. It contains ten activities designed around the instructional model of launch, explore, and summarize.

The first phase of the activity has the teacher "launch" a challenge. This consists of introducing new concepts and definitions, reviewing pertinent old concepts, and posing a problem. Possible dialogue between teacher and students is included here.

The second phase of the activity involves exploration. The teacher is directed to divide the class into groups and hand out the worksheets provided. (The publisher grants permission to reproduce blackline masters for classroom use.)

The third and final component of the instructional model is to summarize. Possible dialogue between teacher and class is also included here as well as an additional worksheet for assignments or extended activity.

The ten activities in the book deal with state lotteries, fair and unfair games, surveys, area models for conditional probability, expected value, and binomial probabilities culminating in Pascal's triangle. In addition to the ten activities, the book contains three computer activities (histograms, fair games, three dice games) built around the instructional model complete with worksheets and a listing of the computer program in BASIC to be typed in for student use. The activities fall into three groups which can be taught as a whole or each group can be used separately. If taught as a whole probability unit, I would estimate about four weeks would be required, depending on the students' abilities and the amount of class time allotted to experimentation.

I like the structure of the activities in the book. The book seems in keeping with NCTM standards promoting more problem solving and manipulative activities. I also liked the area models for conditional probabilities. The area concept makes a difficult topic more accessible to a wider range of students.

In my opinion, the book needs to be supplemented with stem and leaf plots and box plots for the histogram activities. It shouldn't be too difficult to train students to record data from their experiments in this fashion.

In general, I liked this book. It is in ready-to-use form for easier teacher preparation. It posed questions for students to predict answers to, and then let them simulate to compare predictions with simulated answers. It also put the computer simulations late enough in the book for students to have experience in simulations before going to the computer. As in most cases, the book has some shortcomings, but it would be a valuable tool in preparing a probability unit for most grade levels.

– – Linda Young

ANNUAL APPLIED STATISTICS COMPETITION FOR SCHOOLS AND COLLEGES OF FURTHER EDUCATION

Details of the U.K. Statistics Prize 1990-91, now in its eighth year, are currently being circulated to schools and colleges of F.E. The competition encourages cross-circular data-handling and is open to students aged 9 to 19 years. This year, the following themes are being particularly promoted;

1) Simulations and experiments are just as important applied statistics activities as are questionnaire surveys.

2) Probability is an integral part of statistics. It has relevance in modelling and simulating aspects of the real world for research purposes, as well as for interpreting and generalizing research results.

3) Probability can be expressed, by even the youngest students, using terms such as 'possible', 'likely', 'probable', 'certain', etc., long before they