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ABSTRACT

A computer program for population analysis has been developed that is simply written, but relatively sophisticated. It consists of three parts: computation and tabulation of data, statistical analysis and plotting. The program can be understood readily by computation center personnel and requires a minimum of modification for use in most facilities. Once the program is instituted, an instructor need only have knowledge of the format requirements to use it. Lack of a programming background need not prevent an instructor from using the computer for population analysis.

INTRODUCTION

The concept of variation within both organic and inorganic populations commonly is taught in introductory classes in the physical and biological sciences. By means of a population analysis, students combine the measurement, statistical treatment, graphic presentation and interpretation of parameter data from single or multiple populations. The computer is an ideally suited tool for performing these population analyses. Yet few instructors utilize the computer because they lack experience and suitable programs. At present, there is little opportunity for instructors without a programming background to take advantage of the computer for population analyses.

The program described herein consists of three parts: computation and tabulation, statistical analysis and plotting. The program can be readily understood by computation center personnel and requires a minimum of modification for use in most facilities. Once the program is instituted, an instructor need only have knowledge of the format requirements to use it.

THE PROGRAM

The program is written in Fortran IV language. Execution times range from 1:50 to 2:30 minutes. Plotting times average 3 minutes per plot with a Calcomp plotter manufactured by California Computer Inc.

The program will handle in a single operation a maximum of five parameters measured from a maximum of 200 specimens, designated by 10 character identifiers, representing one or two populations. Populations larger than 200 specimens or measurement of more than five parameters can be accomodated by consecutive executions. Parameters are numbered to allow flexibility and to avoid confusion surrounding definition among different groups. A maximum of five ratios of parameters designated by combinations of parameter numbers can be selected for calculation during a single operation. The parameter and ratio data are tabulated in adjacent columns on the printout according to the identifier. Both parameters and ratios are treated statistically to produce the mean, standard deviation, range, median, coefficient of variation, moments of the mean, skewness, moment of skewness and moment of kurtosis. A correlation coefficient also is calculated for each ratio.

The plotting routine requires either an on- or an off-line plotter and is optional. Additionally, off-line plotting requires 800 ft of magnetic tape storage. The routine consists of four parts. The first section produces bivariate plots of parameters. The second section produces histograms of parameters. The third section plots a ratio versus a parameter and the fourth section plots ratios versus ratios. Two populations can be plotted on the same graph for direct comparison.

Other pertinent information and descriptions are included with the program, which is available upon request from the Department of Geology, University of Arkansas, Fayetteville, Arkansas 72701.

PROCEDURE

The program has been used successfully for population analyses of brachiopods and ammonoid cephalopods as exercises in introductory paleontology at the University of Arkansas. However, the program can be used for analysis of any group of parameters from any type of population. Students selected specimens at random from a population, labeled each with a previously assigned identifier and measured five parameters. Each student tabulated the values for his specimens and punched the data on standard computer cards following the program's format requirements. Ratios and graphs were selected, and all data cards were assembled to be run as a group. After execution of the program, students received copies of the printout and plots. Examples of these plots are illustrated in Figure 1. The identification number on

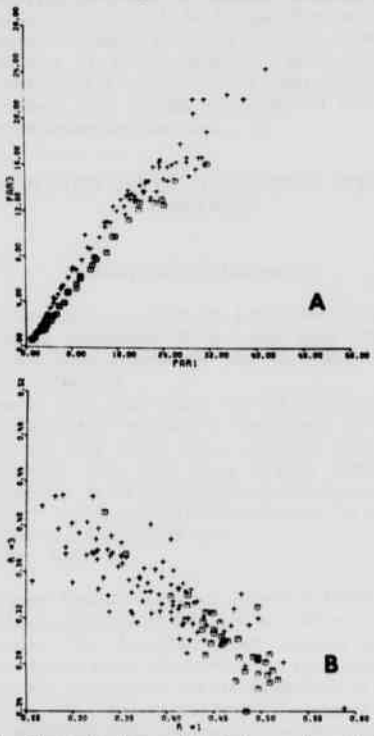

Figure 1. Computer-drawn bivariate graphs. A. Parameter versus parameter. B. Ratio versus ratio.

each specimen allowed rechecking of anomalous values. Students interpreted the variation observed within the population and presented the results in short papers.

CONCLUSIONS

The computer is an ideally suited tool for performing population analyses. Its utilization provides a larger sample than would be available to students working individually. This increased sample size presents a more realistic picture of population variation. Students are also released from tedious, inefficient and many times inaccurate hand calculation and graphing of data. As a result, more time can be spent in the interpretation rather than in the preparation of data. Many instructors still have little familiarity with basic computer application. With this program, lack of a programming background need not prevent an instructor from using the computer for population analysis.

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