

data base and go on to recommend a physical structure (including subschema definition) and suitable data base management software for maintaining and organising this structure.

Module 5 (20 hours)

In this module the students are required to gather together all their previous work and to produce for management a concise proposal for the creation of the XYZ information system. This work is concerned with planning and control of the development, aspects of hardware procurement, evaluation of hardware, systems and performance, and a proposed plan for implementation of the information system taking into account its impact on the organisation.

Module 6 (25 hours)

In this module the students assimilate information about current XYZ systems by designing and implementing in COBOL a program from the sales analysis suite.

Module 7 (25 hours)

In this module the students identify areas of XYZ which they feel would benefit from the application of OR (e.g. transportation, forecasting, etc.) and tackle the problems of applying specific techniques.

- (b) Unsupervised, unmetabled time is not expected of the students on the HND course because of the course structure in the third year. The hours quoted above are more or less an accurate reflection of time spent.

4. Staff involvement

XYZ is a wide-ranging, unstructured case study which can be used in many different ways to suit student needs. Because it is concerned with total system design, staff from all disciplines are involved at many stages.

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Book reviews

Education and Large Information Systems, edited by R. A. Buckingham, 1977; 197 pages. (North-Holland for IFIP, Dfl. 65.00)

The sixteen papers which make up this book formed the material for the 1977 IFIP working conference on educational requirements introduced by large systems. The papers are each followed by a short report of discussion and the whole is preceded by conference recommendations. Several papers are followed by an extensive up-to-date list of references which would be useful to those researching into recent developments in this field. There are descriptive papers on SWIFT, IBM European education, the Netherlands Telephone Customer System and graduate and undergraduate provision in various universities. The remaining papers deal with the interface between the needs of computer users, the education and training of data processing specialists and future problems which may arise from large systems. The need for recent, recurring and relevant experience is pointed out by Etzi alongside the need for more knowledge of available software packages. Zijlker points out that people should not be a part of a system but should ride on top of the system and control it with mutual communication. Engberg emphasises the need for flexible systems and discusses the disappearing work ethic, the objective of economic efficiency and the problem of organisational inertia. Lovick mentions the great difficulty of educating senior user managers. These highlights give some idea of the scope of this book.

P. GILES (Stirling)

Foundations of Microprogramming, by A. K. Agrawala and T. G. Rauscher, 1976; 416 pages. (Academic Press for ACM, £11.70)

Microprogramming has changed a great deal since Wilkes first coined the term in 1951. The objective given then for microprogramming, in Wilkes' often quoted words was 'to provide a systematic alternative to the usual somewhat ad hoc procedure used for designing the control system of a digital computer'. Present day definitions of microprogramming embrace a whole spectrum of programming activities from the control of individual hardware components such as gates to the writing of programs in what is close to a conventional machine code. The broadness of the subject matter, together with the variety of microprogrammable computers on the market, makes microprogramming a difficult topic about which to write a general book.

This present book manages to give the reader a fair grounding in basic microprogramming terminology and a comprehensive discussion of the types of hardware the microprogrammer is likely to meet. This discussion is illustrated by examples from a simple (hypothetical) microprogrammable computer, which however can only make one choice of hardware type for each component from the many offered. The reader is also introduced to some of the currently available microprogramming languages varying from a flowchart specification through to languages not unlike a general purpose high level programming language. The support software, such as translators, emulators, etc., is also given a section in the book. A later chapter includes developments both recent and future (as foreseen by the authors) in the area of microprogramming languages.

Following the general sections, the authors describe, in the terms defined earlier, a number of commercially available user-microprogrammable machines. These are categorised into three types: horizontally microprogrammed, vertically microprogrammed and those whose micro-architecture is a combination of the two. The term 'diagonal microprogramming' is used to describe this last case. Some 13 machines are examined in considerable detail, and another four are described briefly.

The authors conclude the book with an examination of current application areas where microprogramming is employed and topics such as emulation, graphics, signal processing and operating systems are discussed, followed by an attempt to put the whole book into perspective. In this final chapter, the reader is presented with an overall look at the subject including some crystal-ball gazing on the part of the authors.

The book is intended to serve as an introductory text on microprogramming and certainly a reader new to the area should be able to follow the discussion. He will no doubt finish the book, however, realizing that microprogramming is a vast area with many applications where most knowledge must be gained by studying special cases. The authors admit in their conclusions that 'the amount of work done on the subject prohibits a complete examination in a single book', and recognise this fact by giving an excellent annotated bibliography at the end of each chapter. This reviewer would certainly recommend the book as a suitable starting point for anyone wishing to enter the field of microprogramming.

C. R. SNOW (Newcastle)