

of ball lightning but if one analytically reduces the reports in his book one obtains a remarkably consistent account of the phenomenon quoted in the second paragraph of this review. The other reports concern ball-like apparitions but I wonder if they are really members of the family.

R. C. JENNISON

Higher Education

Any Person, Any Study: an Essay on Higher Education in the United States. By Eric Ashby. Pp. xi+110. (McGraw-Hill: New York and Maidenhead, May 1971.) £2.40; \$4.95.

THE Carnegie Commission on Higher Education, whose chairman is Clark Kerr and whose final report is due in 1973, has as its remit to examine the issues facing universities and colleges in the United States between now and the year 2000. The research studies it is sponsoring (some twenty-five have been published so far) are giving it a rich mine of new material; but it has also called upon several distinguished academics from outside the US "to describe and evaluate American education from their respective points of view". The first such commentary is this lucid and perceptive essay by Eric Ashby.

Here is indeed a book to ignite thought; shrewd in its recognition and identification of the problems of American higher education and in selecting those for particular examination about which he has penetrating things to say. But what we are given in effect is a realistic survey of the tasks for higher education which will soon be confronting us in Britain as well as those in the US—for the deeper the digging the more it is in common ground. We too are "at a climacteric of society when assumptions have to be revised".

In his treatment of such questions as who should be given higher education, what should be taught, who should teach it, and how research should be funded, Ashby has much that is pertinent to say. Is not a good deal of the work done for PhDs here too "competitive instead of contemplative"? How are we going to cope with the lack of motivation among some of those whom the nation needs to have highly educated? What is the proper content of a two-year course—whether leading to an AA, a BSc or a Diploma in Higher Education?

A few queries: this is a very masculine piece; would one gather from it anywhere that nearly a third of the students being talked about are likely to be women? Nor am I as sure as Ashby that a university's "own thing" is adequately covered by defining it, admirable though the definition seems, as "the pursuit of knowledge through

rational enquiry and discourse" unless "rational" and "discourse" are both widened beyond normal usage. An understanding of Mozart, Henry Moore, Corot, Psalm 139, the Bhagavadgita, the *Prelude* are highly rational occupations but the elemental activity of mind involved is not what is usually thought of as cognitive. I should maintain that to encourage the appreciation of any or all these works is very properly a function of higher education. To be humanely educated people need to retain experiencing power while adding to it critical power and among the deficiencies of university study today for very many is over-concentration on the latter at the expense of the former. Unless those who represent the university are widely and humanely educated how can they act as Ashby wants them to, as interpreters of their nation to itself—in other words its critics? For they have to recognize the educational needs of their society before being able to declare what they are and be possessed of some concept of the good life.

On the administrative side, Ashby boldly advocates a loosening of institutional bonds to give departments and colleges more autonomy. Perhaps there is no other remedy: but will enough consensus emerge to provide a really generous education for most students in civic universities and in polytechnics in our time? He says indeed less than he might have done (had he not rightly been concentrating first and foremost on the American scene) about relations between higher and further education. This may well be one of the key areas of difficulty in Britain in the next decade.

No more concentrated, wide-ranging and illuminating book about higher education has been published of late. It is profoundly concerned about the function of the university in the period ahead. Could we have a paperback edition? W. R. NIBLETT

Sentence Logic

Computer Logic. By Alan Rose. Pp. xii+180. (Wiley: London and New York, November 1971.) £4.

THE use of sentence logic to analyse relay and switching circuits was discovered by the American C. E. Shannon in 1938 and the Russian V. A. Rozenberg in the following year; landmarks in the modern development of the subject were the publication in 1951 of D. B. McCallum and J. B. Smith's paper on "Mechanized Reasoning—Logical Computers and their Design", and the 1956 volume, in the Princeton Annals of Mathematical Studies, of *Automata Studies*, edited by C. E. Shannon and J. McCarthy.

The author of the present work is well known for his extensive studies of

many-valued logics as well as for his successful applications of logic to problems in computer design. The book itself reflects the author's dual interests and his account of sentence logic is developed side by side with the practical applications of logic to the theory of decision elements.

On the purely logical side the main results established include the sufficiency of negation and disjunction for the generation of all truth functions, and the generation of negation and disjunction from each of the Sheffer functions, joint denial and incompatibility; the existence of the normal forms; and the conditions for a sentence composed entirely of variables, negations and equivalences to be a tautology.

Many and varied electrical models of sentence logic are discussed in detail. The basic element is the familiar make-and-break circuit of the electric bell, known as a relay. A particularly interesting example is the representation of conditional disjunction " $(P \text{ and } Q)$ or $(R \text{ and not-}Q)$ " by a relay in which Q is connected to earth through the coil and the switch moves between wires carrying inputs P and Q respectively.

There is an account of the Nottingham University logical computer designed by E. Foxley. An interesting feature of this computer is that it uses a decision element $\Phi(P, Q, R, S, U, V)$ from which each of the eight binary truth functions, disjunction, conjunction, implication, non-implication, equivalence, non-equivalence and the two Sheffer functions, are obtained just by a substitution of constants for two (or four) of the variables; $\Phi(P, Q, R, S, U, V)$ is in fact the conditional disjunction with P and V as first and third terms and with middle term the conjunction of the disjunction of Q and R and the incompatibility of S and U .

Perhaps the deepest section of the book is an account of work which the author did for English Electric in connexion with the design of a reactor for a nuclear power station. The problem was to find a control mechanism which would rotate a wheel through an angle which was a multiple of π/n , a multiple (positive or negative) determined both by the momentary position of the wheel and a given input number, together with certain safety requirements.

The author's aim was to write an introductory account of the subject suitable for those intending to work with computers but who have no previous knowledge of mathematical logic, and he has been highly successful. The mathematical prerequisites for reading the book are very modest, little more than a familiarity with symbolic notation and mathematical induction, and the book could be read with profit by an intelligent science sixth-former. R. L. GOODSTEIN