THE COMPUTER AND YOU

A Proposed New Course on the Impact of Computers on Society

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Purpose

That the applications of computer systems are having an increasing impact on the lives of people at present as well as for the foreseeable future has become commonly accepted to almost everyone, particularly to the citizens of highly industrialized countries such as the United States. Creating and implementing means for educating people to cope with the issues and problems raised or promised by these information processing systems is of importance especially in any form of democracy. This is particularly true since little accurate and detailed knowledge of the larger problem has been widely disseminated. One often hears people express ignorance or misconceptions concerning the particular issues with some commonly mentioned pervasive fear of consequences for people from computer systems in the future. Something must be done!

Large segments of the populace must be given adequate bases for decision-making insofar as the applications of computer systems promise to affect the present and future. This paper proposes a university course as a realistic and practical approach to the creation of these bases in an important segment of the population--college undergraduates.

The Growth of Computer Usage

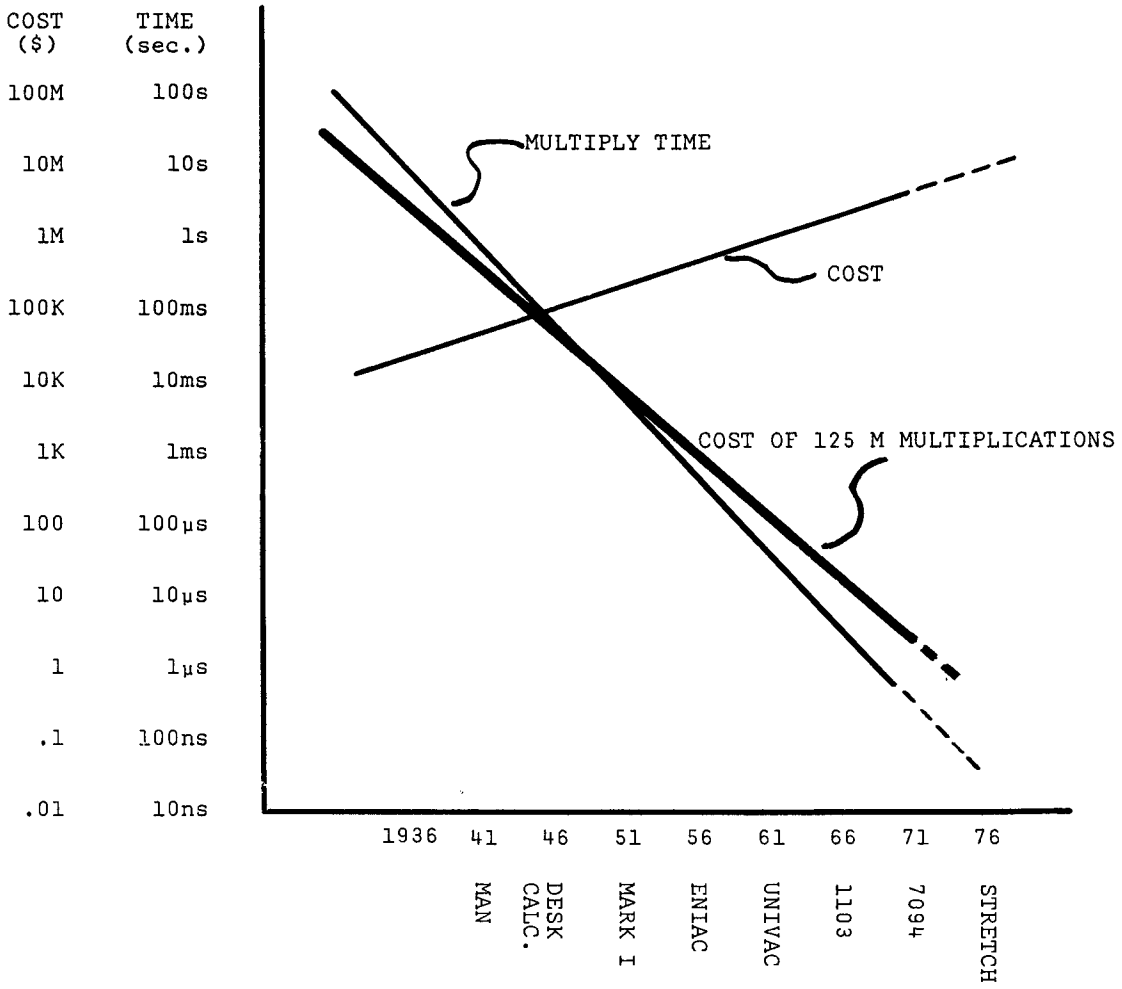
The actual and estimated growth in the number of computer installations in the U.S. from 1950 until 1975 is expressed by the following table (found also in Computers in Higher Education, a report of the President's Science Advisory Committee, p. 58):

Year	Total Installations
1950	10 - 15
1955	1,000
1960	6,000
1965	30,000
1970	50,000
1975	80,000

A clearer perception of the actual increase in effective computing power which can be purchased per dollar can be gotten from the figure on the following page (also based on data from Computers in Higher Education, p. 60).

The decrease in multiply time, the slight increase in cost and, cumulatively, the decrease in the cost of multiplications since before the middle 1930s, all closely approximating strict linearity, demonstrate through extrapolation on the past and present trends that the cost of computing will continue to decrease significantly into the future. Little accurate measure of the actual computing power in use at any particular

time is available or possible but it can be assumed to be enormous. Again, to date, the impact of these machines has been significant and the data show that their use and power are still in a period of very rapid growth which accentuates the need for a course now to be concerned with current and emerging societal issues raised by the myriad applications to which the end-user has and will make of the computer and its associated software.



TRENDS DEMONSTRATING THE STEADY AND VIRTUALLY LINEAR DECREASE IN COST OF COMPUTING

Problem Areas Related to the Development of the Course

Realistic concern should be shown by the course planners for aspects of the existing student body, university academic milieu, and the actual available resources before and during the creation and implementation of the new course.

The audience should be a directly available group eager and willing to learn. Presumably such conditions are met by college undergraduates. First and second year students

from all disciplines might be those generally aimed for. They should need to satisfy no prerequisites for entrance into the course. A smaller audience, but an important one to reach, are practicing and promising educators, particularly secondary, both within and outside the active university community. Any course of this nature should emphasize trying to relate to this group.

The decision on placement of the course involves a consideration of two other questions: (1) Where does it go now? and (2) Where should it be later ideally? Early, the course has to be located where convenient for the available human and computer resources. Computer sciences departments, where they exist, would be the most desirable initial home. This recommended placement certainly should not preclude the active involvement of other faculties in the course development and implementation. All of the situations will be unique, often requiring placement elsewhere, again where of the greatest utility vis-à-vis the students and resources. Later, after the early development phase of the course is complete and many other disciplines have had some part of its design and implementation; after growth of involvement with computer usage by other departments; the course might then be best placed elsewhere--perhaps in a new department such as one on "contemporary issues."

Central to questions about the development of the course are questions concerning the availability of resources. Assuming students to be a resource, how can they be most effectively accessed? How can they best communicate with the teaching and source personnel resources? How can computing resources be best related to the course scheme? How can the educational facilities be best utilized by the course? The four questions must be considered in unison for answers which will be unique to the situation at the college or university initiating such a program. In planning this particular course, attempts should be made to glean as much information as possible about the available resources. It is necessary to base decisions about the organization and implementation of the course upon such information. Those decisions will guide the creation of the course, and the quality of the course--given the real resources--will highlight the quality of study and planning--and teaching, too--which went into it.

A Proposed Course Content Outline

The following course outline is to be considered tentative and certainly far from definitive. It supplies one overall organization as a jumping-off point from which a progressively more effective and relevant course can grow as experience is gained with its implementation. The outline is for a three-credit, one-semester course of the type which meets for roughly three 50-minute sessions per week.

Philosophically, the outline shows concern with taking a practical approach to selecting and organizing the course content with the following major partitions: (1) requiring students to have a "real" experience interfacing with a computer system; (2) giving significant effort to studying software applications in the "real world" from the point of view of the end-user; and (3) raising the various societal issues suggested by the applications.

Outline for "The Computer and You"

Course Topics	Time, Assignments & Examinations
1. A perspective on the course	3 sessions
1.1 Introductory remarks on the focus of the course	A paper might be assigned at this time to be due three weeks before the end.
1.2 The history of the concern with societal issues raised by computer applications A series of readings can be relied upon here from such authors as N. Wiener, B. Russell, H. Kahn, etc.	
1.3 Raising some initial societal issues Issues of a moral, cultural, political, social, etc., nature can be approached with some initial attempt made at focusing them.	
2. Considerations about the computing machine	3 sessions
2.1 The historical development of the machine	Reading assignments on societal issues.
2.2 The organization of the machine	
2.3 Modern computers	
2.4 Communicating with the computer These topics are to be interleaved with the other three preceding in this section. This is intended to permit students to begin actively communicating with the machine early in the course which can help ease their introduction to a more formal presentation of basic FORTRAN programming to follow.	
2.4.1 Using a keypunch	
2.4.2 The computer system to be used	
2.4.3 A sample of simple programs	
2.5 A consideration of any societal issues which might have newly emerged	
3. Programming the computing machine	3 sessions
3.1 Languages	Reading assignments to continue on societal issues.

3.1.1 Machine language

Programming examples supplied.

3.1.2 Assembly language

Programming examples supplied.

An examination should follow the completion of this section.

3.1.3 Higher level languages

3.1.3.1 FORTRAN

3.1.3.2 Other languages

Programming examples will be supplied here.

3.1.4 Compilation and execution of programs

3.2 Computer systems

3.2.1 Their history

3.2.2 Modern systems

3.3 Using the available system to communicate with a computer in FORTRAN

This section will require that students continue their initial programming exposure with opportunities to do such things as correct simple programs with errors or write an extremely simple program. These activities are to be interleaved with those of the previous topics in this section.

3.4 A consideration of any societal issues which might have newly emerged, especially from the students' new focus on software

Issues should emerge for discussion from time to time as a result of the students' reading and research on their papers.

4. Basic FORTRAN programming — 12 sessions

4.1 FORTRAN

A few weeks spent in giving students a realistic experience programming 3 or 4 relatively simple and thoroughly understandable problems in addition to those to which they have been exposed earlier.

An examination on FORTRAN should follow the completion of this section.

4.2 Consideration given to any new societal issues raised by the students

5. The world of software applications — 16 - 18 sessions

5.1 Software in a historical perspective

5.2 Modern software, software applications by the end-user, and societal issues

Several weeks of study of the kinds of software in use in the "real world." Programs used for data processing, information retrieval, analytic computation, non-numeric problem-solving, simulation, etc., will be studied from the point of view of the impact of their application on man: the individual and society. Moral, economic, cultural, social and other human value issues will permeate the study.

An examination on software and societal issues should follow the completion of this section.

6. Using an actual software package	3 sessions
6.1 The package The students will be required to interface with a commercially used canned program. Report Program Generator (RPG) is such a package which is available for many computers, large and small, which could be used by students with a minimum of additional programming experience. RPG is a limited purpose programming language without complicated logic such as that found in FORTRAN. It is used for preparing programs to perform some relatively easy computations generating an output in the format of a report. RPG permits specification of the report form.	Reading assignments to continue on societal issues. The papers assigned at the beginning of the course are to be collected now.
6.2 Consideration of societal issues	
7. Societal issues reconsidered	3 sessions
7.1 Additional speculations on the present 7.2 Speculations on the immediate future 7.3 Speculations on the distant future	Some of the papers might be discussed with select ones presented by their authors.
8. Summary and conclusions	1 session
8.1 Impact of the course on the students 8.2 Proposals for action in dealing with any problems raised by the use of the computer 8.2.1 Questions of value for people 8.2.2 Questions of practical action 8.3 Feedback from the students on needed improvements to the course	A final examination to be given after this session should include questions concerning the history of computing, programming in FORTRAN, machine organization, general examples of software applications, a specific example of a software package, and the many aspects of the societal issues.

Research must go into developing effective reading, audio-visual, programming, human and other resources for the course. Experience with developing and teaching this type of course is of the greatest importance.

Aspects of Presenting the Course

The lectures should be as interesting as possible with many opportunities for interaction with the students either as a body or in smaller groups. Seminars would be of use. Imaginative use of audio-visual aids, field trips--judicious use is also recommended here--and invited presentations by informed speakers can all add good dynamic qualities to the course. A widely varied but pertinent set of informative and interesting outside readings is a must for assignment to the students. A few books have appeared recently which could serve as textbooks. Realistic interaction with a computer system is required by the course instead of simulated or no interaction, since it is thought that the course should maintain as much as possible a closeness to real computers

for the students.

Speculations on the Future of the Course

Keeping such a course in a computer sciences department has its limitations, especially as we move into the future and with other fields becoming enmeshed with computer usage. The course could integrate some material from such other campus programs as management science, economics, philosophy, history, psychology, sociology and so on. A particular relevance of this course to a previously-mentioned possible new department of "contemporary issues" is obvious. One, more extensive, possibility would be the creation of a kind of "super department" of the three departments--one is old, two are new--history, "contemporary issues" and "futures." The three in unison should serve as a focus for studies leading to more practicable plans for dealing in the present and future with the various aspects of the impact of technology on man.

In summary, the course is proposed not to be a definite solution to the problems facing man concerning the applications of computers, but to be a recommended approach which is possible now. Some approaches to preparing man to deal with the effects of these systems must be taken. The most pressing need is for experience with different approaches.

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