The Machine That Changed The World: Inventing The Future

Assignment 3 Answers.

1) Which was more important in the early development of the computer industry: scientific innovation, federal government spending, or the forces of free-market capitalism? Explain.

Federal government spending.

In the film, the first uses of the electronic digital computer, the ENIAC was for military use such as: calculating trajectory tables for shells fired from large guns and research for the first atomic bombs. Later, Eckert and Mauchly developed the UNIVAC for another government agency, the U.S. Census Bureau. Business did not think the digital computer was useful. IBM thought the computer was only useful for scientific calculations.

2) What were the initial difficulties that had to be overcome to make a successful computer business? Explain.

Development problems, high cost, low reliability, difficulty of use,lack of financial resources, lack of customers, McCarthyism, resistance to change, etc., affected the success of the early computer business.

Computers' high cost was reduced as the demand for them increased, assembly line techniques were applied to their production, and competition increased. Reliability improved through the development and use of solid state electronic components and assembly line production. Programming difficulty because of the need to program in binary and machine code was overcome by the invention and use of higher level languages which were more easily understood and easier to debug. The first commercial computers were purchased by the military and government. Commercial investors, such as Remington Rand, were found to enable the further development of the UNIVAC. Increasing numbers of and varieties of computers were sold as businesses realized that computers could be economically applied to their operations. McCarthyism seriously damaged the ability of the Eckert-Mauchly Computer Company to sell computers, especially to the U.S. military and government and, consequently, to raise capital. This was overcome when Remington Rand bought E-MCC. Resistance to change by business was overcome by IBM using existing punch-card technology for computer

data processing.

3)What were the initial applications for computers and how did the technology develop in accordance with market forces? Explain.

The ENIAC, the first electronic computer capable of carrying out general-purpose calculations, was used near the end of World War II by the military for various purposes such as ballistic trajectory tables and the development of the atomic bomb. The public was informed about the existance of the ENIAC in 1946. In 1949, Remington Rand, which became Sperry Rand and is now known as UNISYS, introduced the first business computer, the Remington Rand 409. In 1951, the U.S. military began using two more computers,the EDVAC and the ORDVAC. Also, in March 1951, the U.S. government received delivery of the UNIVAC I from Remington Rand, which was used to analyze the Census. More UNIVAC I computers were purchased by the U.S. government and military. Contracts to purchase UNIVAC I computers were made with the Prudential Life Insurance company and A.C. Nielson, a market research company but, because of cost overruns, were convinced by Remington Rand to cancel their contracts. Subsequently, the first UNIVAC I computer for business use was sold to General Electric for payroll. Later, other UNIVAC I computers wer sold to DuPont and Pacific Mutual Insurance and other insurance companies.

In 1951, the Ferranti Mark I became available in Britain, from the Ferranti company. In the same year, in Britain, J.M. Lyons, a very large baked goods manufacturer and distributor, introduced the LEO I, which was used for accounting and inventory management purposes. The LEO I was the first computer used for routine business office tasks. J.M. Lyons sold LEO II computers to other companies.

As business realized that the computer could save time and money, it was applied more widely.

In 1952, IBM produced the 701, their first large commercial computer. In 1953, IBM began selling the IBM 650, their first production line manufactured computer. The IBM 305 RAMAC was introduced in 1957.

4) What problems caused the invention of higher level programming languages and what were the solutions? Explain.

Before high level programming languages existed, computers were programmed one instruction at a time using binary or hex. This was a tedious job and there were a lot of errors. Programs were difficult to read, and modification was extremely difficult because all programs had to be written using absolute addressing. Obviously, this job did not attract many people, so there was a shortage of programmers. Expensive computers sat idle for long periods of time while software was being developed. Software often cost two to four times as much as the computer. This led to the development of assemblers and assembly languages. Programming

became somewhat easier, but many users still wanted floating point numbers and array indexing. Since these capabilities were not supported in hardware, high level languages had to be developed to support them.

5) What was the significance of the 1952 Presidential Election in the history of the computer industry? Explain.

In the 1952 election in which the UNIVAC computer was used by CBS to predict the output of the race (and incidentally censored by CBS for several hours after predicting the outcome correctly with only 5% of the vote counted) was won by Dwight D. Eisenhower. CBS didn't believe the computer's prediction and ignored it but, after the election results were determined by usual methods, the computer's prediction was revealed to the public. This caused a great deal of general interest in electronic computers.

6) Which company eventually prevailed/dominated the computer industry and why? Explain.

International Business Machines (IBM).

Although Remington Rand, which purchased the Eckert-Mauchly Computer Corporation in 1950, was well ahead of IBM in the development and sale of commercial electronic computers, IBM caught up with and overtook Remington Rand because it developed a computer which used pre-existing punch-card technology and its computer was made on a production line which made it relatively cheap, it had a large established and agressive sales force with extensive prior experience selling data processing equipment to business, and an excellent reputation for supporting its products.

7) What is the Integrated Circuit (I.C.) and why was it so important? Explain.

The Integrated Circuit (I.C.), is a miniature electronic circuit constructed of multiple active components, such as transistors, and passive components, such as resistors and capacitors, on a single slice of silicon which are interconnected by miniature conductors deposited on the silicon. These circuits are made through a photolithographic process which enables numerous exact duplicates of the circuit to be simultaneously manufactured on a wafer of silicon.

Different aspects of the Integrated Circuit (I.C.), were invented seperately by Jack Kilby at Texas Instruments (U.S. patent #3,138,743) and Robert Noyce (U.S. patent #2,981,877)at Fairchild Semiconductor. Jack Kilby invented miniature electronic circuits. Robert Noyce invented a process for making multiple transistors on a single piece of silicon. Texas Instruments and Fairchild Semiconductor cross-licensed their inventions which enabled Fairchild to develop the first commercial I.C.

Although the I.C. had many advantages over existing electronic circuits, much more powerful

per cubic inch of size, very low power consumption, cheaper cost to produce computers, high reliabiltiy, etc., each I.C. was extremely expensive which prevented commercial use. The development of a miniature computer, by NASA, for use in Apollo 11, the first trip to the moon by humans enabled the cost of the I.C. to be reduced and proved to business that the I.C. was of practical use.

The I.C. was absolutely essential for the development of cheaper and more powerful industrial process and business computers, the personal computer, the miniaturization of consumer electronic devices such as cell-phones, and the development of new electronic products such as laptop computers and personal digital assistants (PDA).

8) What concerns were there about the application of the computer? Explain.

Many people were concerned about the transfer of their work to computers, automation, which would cause them to be unemployed. This fear was well-founded, particularly for any work which is mathematical and/or repetitive. The Prudential Insurance Company was able to avoid hiring thousands of new accountants which were needed, because of a change law, to recalculate actuarial tables. Not only did Prudential avoid additional hiring, it replaced virtually all of its accountants. Banks also replaced virtually all of their data entry employees when magnetic ink coding of cheques was implemented. Computers were applied to many factory jobs which were repetitive in nature. This fear was expressed in films such as Desk Set starring Audrey Hepburn and Spencer Tracy. Tom Watson Jr. of IBM told the public that the computer would relieve people of boring repetitive work, freeing them to do more interesting and creative work.

9) What did you find interesting in the documentary? Explain.