Diversion II

Suppose I offer to give you one of three prizes, Prize A, Prize B, or Prize C.

- Prize A is the best of the three
- Prize B is unremarkable
- Prize C is the booby prize.

You are to make a statement;

- if the statement is true, then I promise to award you either Prize A or Prize B,
- but if your statement is false, then you get Prize C.

Question 1. What statement can you make which would force me to give you Prize A?

Diversion II (cont)

Suppose I add a fourth prize - Prize D - which is also a booby prize.

- If you make a true statement I promise to give you either Prize A or Prize B
- if you make a false statement I will give you either Prize C or Prize D.

Suppose you have your heart set on Prize C.

Question 2. What statement could you make that would force me to give you Prize C?

Diversion II (cont)

Suppose we again have the same four prizes and conditions.

But now you don’t care for any of the prizes.

You merely wish to confound me by making a statement which will force me to break my promise.

Question 3. What statement would do this?

This problem is essentially the same one known as the Sancho Panza Paradox described by Cervantes in Don Quixote
Core Curriculum
- Intro & Intermediate Programming
- Discrete Math
- Digital Systems
- Computer Organization and Design
- Data Structures & Algorithms
- Programming Language Concepts
- Computer Architecture
- Operating Systems

Computer Science Curriculum
- Statistics
- Algorithms & Computational Science Elective
- Software Design Elective
- Intelligent Information Processing Elective
- Software Engineering Capstone Design

Computer Engineering Curriculum
- 2- Circuits & Devices (EE)
- Signals & Systems (EE)
- Hardware Design Elective
- Software Design Elective
- Intelligent Information Processing Elective
- Computer Engineering Capstone Design

A Little History
Question 4. When were the first (electronic) computers built?
Question 5. What was their primary function?
Question 6. When was the PC introduced?
Question 7. What are primary uses of computers today?

A Little History
Question 8. Who were the first computer scientists?
Question 9. Who were the first computer engineers?
Question 10. Who were the big players in the computer industry?
Question 11. What were the significant events in the history of computers?
Original IBM PC - 1981
- 4.77 MHz Intel 8088 Processor,
- 16KB of RAM memory (expandable to 256KB)
- Microsoft DOS 1.0
- two 384KB floppy disks
- 11” monochrome monitor
- Stand-alone
- $3000

Your PC Today
- 3 GHz CPU, 1GB of RAM memory (expandable to 4GB)
- 120 GB disk
- 17” monitor
- DVD, CD-RW, Network, Sound
- $900

1984

Question 12. What happened in 1984?

Today, we celebrate the first glorious anniversary of the Information Purification Directives. We have created, for the first time in all history, a garden of pure ideology. Where each worker may bloom secure from the pests of contradictory and confusing truths. Our Unification of Thoughts is more powerful a weapon than any fleet or army on earth. We are one people, with one will, one resolve, one cause. Our enemies shall talk themselves to death and we will bury them with their own confusion. We shall prevail!

Macintosh - 1984
Macintosh - 1984

- 128 kB of RAM
- 64 kB of ROM
- 400 kB floppy disk (No hard disk)
- 8 MHz CPU (MC68000)
- $2495
- 10 MB Hyperdrive ($2000 extra)
- ThunderScan (a "High Resolution Digitizer for Macintosh")

Macintosh - 1984

Question 13. What’s the point of the ad?

Question 14. Why did Apple try to pull this ad before it ran?

Question 15. What was society’s view of computers in 1984?

Question 16. How are computers marketed today?

History - Mainframes

(from PBS Triumph of the Nerds)

- 1941: Konrad Zuse completes the first general purpose programmable calculator. binary math, boolean logic
- 1943: Colossus, a British computer used for code-breaking, is operational by December.
- 1946: ENIAC developed by Ballistics Research Laboratory for firing tables; built at the University of Pennsylvania
- 1947: Bell Telephone Laboratories develops the transistor.
- 1951: UNIVAC, the Universal Automatic Computer is developed.
- 1959: Texas Instruments and Fairchild semiconductor both announce the integrated circuit.
- 1964: The IBM 360 is introduced generates more than $100 billion in revenue

Mini Computer

- 1965: An IC that cost $1000 in 1959 now costs less than $10. Gordon Moore predicts that the number of components in an IC will double every year. This is known as Moore's Law.
- 1968: Doug Engelbart demonstrates a word processor, an early hypertext system and a collaborative application: three now common computer applications.
- 1968: Gordon Moore and Robert Noyce found Intel.
- 1969: Xerox creates its Palo Alto Research Center - Xerox PARC. Its mission is to explore the "architecture of information."
- 1970: Intel introduces a 1K RAM chip and the 4004, a 4-bit microprocessor. Two years later comes the 8008, an 8-bit microprocessor.
The Personal Computer

- **1971**: Bill Gates and Paul Allen form Traf-O-Data to sell their computer traffic-analysis systems.
- **1971**: Intel introduces the 4004, its first microprocessor (4-bit).
- **1971**: Steve Jobs and Steve Wozniak are building and selling "blue boxes" in Southern California.
- **1972**: Intel introduces the 8008, the first 8-bit microprocessor.
- **1974**: Jonathan A. Titus designs the Mark-8, "Your Personal Minicomputer," according to the July cover of Radio-Electronics.
- **1974**: Intel introduces the 8080 microprocessor. Used in the Altair computer (named after a star system in a Star Trek episode), a “kit” computer that can be built for $400.
- **1975**: Popular Electronics features the MITS Altair 8800 on its cover, January 1975. It is hailed as the first "personal" computer.

The Personal Computer

- **1975**: Paul Allen and Bill Gates develop BASIC for the Altair 8800. *Microsoft is born.*
- **1976**: Apple is selling its Apple I, bolted together in wooden cases, for $666.66.
- **1977**: Apple is selling its Apple II for $1,195, including 16K of RAM, color graphics, audio cassettes for storage, but no monitor.
- **1977**: Radio Shack is selling its TRS-80; Commodore selling its Commodore-64
- **1979**: Software Arts develops Visicalc, the first spreadsheet program.
- **1980**: Apple has captured 50% of the personal computer market.
- **1980**: Microsoft is approached by IBM to develop BASIC for its personal computer project.
- **1981**: The IBM PC is released in August.
- **1984**: The Apple Macintosh debuts
- **1985**: Microsoft Windows 1.0 ships in November
- **1985**: Motorola announces the 68040, a 32-bit 25MHz microprocessor.

Networking

- Timesharing, the concept of linking a large numbers of users to a single computer via remote terminals, is developed at MIT in the late 50s and early 60s.
- **1962**: Paul Baran of RAND develops the idea of distributed, packet-switching networks.
- **1969**: ARPANET goes online.
- **1973**: Bob Kahn and Vint Cerf develop the basic ideas of the Internet
- **1974**: BBN opens the first public packet-switched network - Telenet.
- **1979**: A UUCP link between the University of North Carolina at Chapel Hill and Duke University establishes USENET.
- **1979**: The first MUD is also developed at the University of Essex.
- **1982**: TCP/IP (Transmission Control Protocol and Internet Protocol) is established as the standard for ARPANET.
Networking

- 1987: The number of network hosts breaks 10,000.
- 1989: The number of network hosts breaks 100,000.
- 1992: The number of network hosts breaks 1,000,000.
- 1993: The World Wide Web sports a growth rate of 341.634% in service traffic in its third year
- 1994: The main U.S. Internet backbone traffic begins routing through commercial providers
- 2002: The number of network hosts breaks 150,000,000.
- 2005: The number of network hosts approaches 317,000,000.

Recommended PC

- Latitude D810, $1,401
- Pentium M Processor 740 (1.73GHz) w/ATI RADEON X300 64MB
- Genuine Windows XP Professional
- 512MB DDR2 533MHz SDRAM, 2 DIMMS
- 80GB Hard Drive, 9.5MM, 5400RPM
- 24X CD-RW/DVD
- Dell Wireless 1370 802.11b/g WLAN miniPCI Card

Question 17. What does all this mean?
Basic Computer Structure

- Central Processing Unit (CPU)
  - Machine Instruction Execution
  - Arithmetic Processing Unit (ALU)
  - Floating-Point Executions
  - Control Unit to tie it all together

- Memory
  - Hard Disk
  - RAM
  - Cache (L1, L2, L3)

Basic Computer Structure

- Input/Output
  - Display (graphics)
  - Network
  - Printer
  - Mouse
  - Keyboard

- System Bus
  - All components communicate across this bus

Functional Organization

- The CPU performs all arithmetic operations and controls the I/O operations.
- Massive memory such as RAM, ROM or disk storage interfaces the CPU through the bus (a parallel line of communication connecting fast peripherals).
- Slower and more remote (external) devices connect via some bus translators.
- I/O management controls the parallel communication of different memory areas with different input/output devices.
Program Execution

- read program instruction from memory
- read required data from memory
- compute result
- store result to memory
- (repeat)

CPUs

- Main properties: speed and versatility of hardware operations.
- Small power consumption allows packing more transistors together and use in powerful portable computers.
- Different instruction set, i/o speed.
- Common Families:
  - Intel: 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV
  - Motorola: MC68000, MC68040, MC88110, PowerPC 7457 (G4)
  - Sun: Sparc, SuperSparc, UltraSparc
  - IBM: PowerPC 970 (G5)

Elements of Computer Hardware

- Transistors are the smallest computational elements.
- Boolean functions and memories are formed by groups of transistors.
- Elementary addition and multiplication is done by boolean functions and memory elements called Flip/Flops.
- Integrated circuits contain a large number of such functions.
- Printed circuits boards contain several integrated circuits to form a either a full computer or specific i/o functions.

Software Organization

- User write a program in *High-level Language*
- *Compiler* (another piece of software) translates user’s program into Processor’s machine language
- Processor can then execute the program
### The Intel Processor History

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
<th>Transistors</th>
<th>Microns</th>
<th>Clock</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>4004</td>
<td>1971</td>
<td>2,300</td>
<td>10</td>
<td>108 KHz</td>
<td>4 bits</td>
</tr>
<tr>
<td>8008</td>
<td>1972</td>
<td>3,500</td>
<td>10</td>
<td>200 KHz</td>
<td>8 bits</td>
</tr>
<tr>
<td>8080</td>
<td>1974</td>
<td>6,000</td>
<td>6</td>
<td>2 MHz</td>
<td>8 bits</td>
</tr>
<tr>
<td>8088</td>
<td>1979</td>
<td>29,000</td>
<td>3</td>
<td>5 MHz</td>
<td>16 bits</td>
</tr>
<tr>
<td>80286</td>
<td>1982</td>
<td>134,000</td>
<td>1.5</td>
<td>6 MHz</td>
<td>16 bits</td>
</tr>
<tr>
<td>80386</td>
<td>1985</td>
<td>275,000</td>
<td>1.5</td>
<td>16 MHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>80486</td>
<td>1989</td>
<td>1,200,000</td>
<td>1</td>
<td>25 MHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>Pentium</td>
<td>1993</td>
<td>3,100,000</td>
<td>0.8</td>
<td>60 MHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>Pentium II</td>
<td>1997</td>
<td>7,500,000</td>
<td>0.35</td>
<td>233 MHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>Pentium III</td>
<td>1999</td>
<td>9,500,000</td>
<td>0.25</td>
<td>450 MHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>Pentium 4</td>
<td>2000</td>
<td>42,000,000</td>
<td>0.18</td>
<td>1.5 GHz</td>
<td>32 bits</td>
</tr>
<tr>
<td>Itanium</td>
<td>2001</td>
<td>25,000,000</td>
<td>0.18</td>
<td>800 MHz</td>
<td>64 bits</td>
</tr>
<tr>
<td>Itanium 2</td>
<td>2002</td>
<td>220,000,000</td>
<td>0.18</td>
<td>1 GHz</td>
<td>64 bits</td>
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<tr>
<td>Itanium 2</td>
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<td>0.18</td>
<td>1.5 GHz</td>
<td>64 bits</td>
</tr>
<tr>
<td>Pentium 4</td>
<td>2004</td>
<td>178,000,000</td>
<td>0.13</td>
<td>3.4 GHz</td>
<td>32 bits</td>
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</tbody>
</table>

### The Pentium IV

- Hyper Pipelined Technology
- Rapid Execution Engine (ALU)
- 800 MHz System Bus (128-byte lines)
- Execution Trace Cache (Level 1)
- Advanced Dynamic Execution
- Streaming SIMD Extension 2 (SSE2)

### Intel Core Duo

- Two execution cores in a single processor
- Advanced Stack Management
- Shared 2MB Level-2 Cache
- On-die 32KB Level-1 Instruction & Data Caches
- Streaming SIMD Extensions 2 (and 3)
- Advanced Branch Prediction