Introduction to Computers: learn, think, have fun

What is a computer?

- A computer is a machine which follows a set of instructions to perform calculations or to store, process, and retrieve information. A sequence of instructions which tells a computer how to do something is called a program.
- A computer does not think. It only understands a specific program. A computer is not intelligent. However, it can follow instructions very fast. Some computers can perform more than 10 million instructions every second.

Where can computers be found and what are they used for?

offices - accounting, word processing

schools - teaching, reference

homes - games, records

Can you name some items which use computers?

microwave oven, car, video games, VCR

TIME: 40 minutes

• discuss what we are trying to accomplish with “Intro to Computers”

-learn what a computer is and the basics of how they work

-think about and begin to understand what is really going on when we are using computers rather than simply using them

-have fun

• ask the question “What is a computer?”

-modify the definition as appropriate and write it on the board

• ask the question “Where can computers be found and what are they used for?”

-modify the list as appropriate and write it on the board

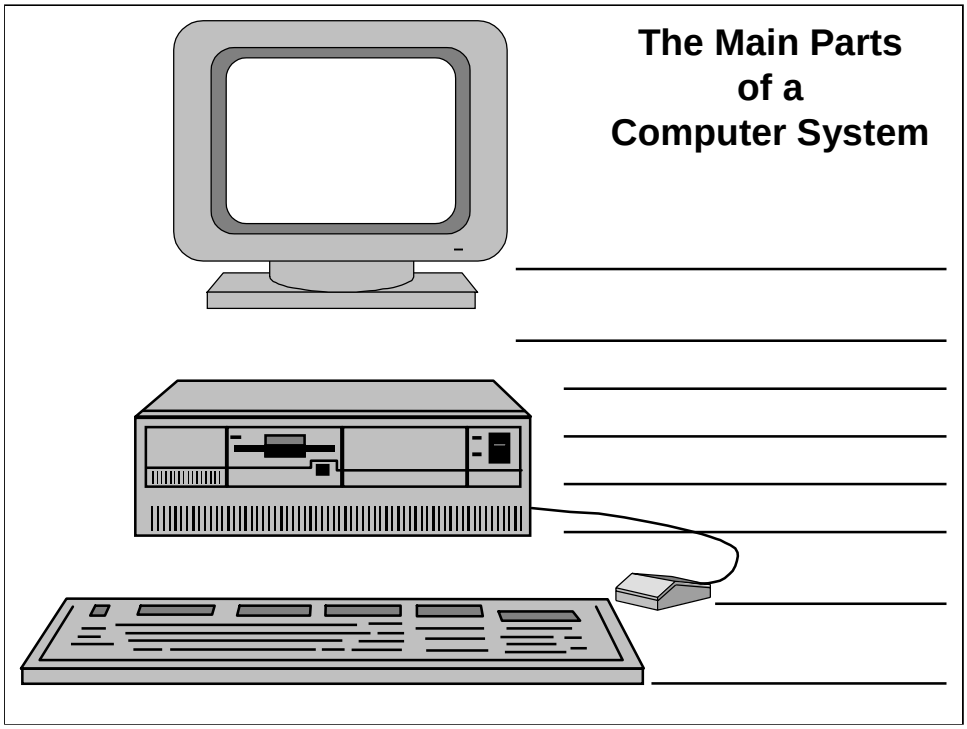
• ask the question “Can you name some items which use computers?”

-modify the list as appropriate and write it on the board

• discuss the issue of “computer jargon” and acronyms

eg. program bug, *PC*, Mac

-discuss keeping a list and adding to it every time such a term comes up - (include *words in italics* in the list)



TIME: 25 minutes

• ask the question “What are the main parts of a computer system?”

-as the class comes up with items, discuss what they are and write them on the board as appropriate

• after the basics are listed, hand out the diagram and work through filling it in:

Display

System Unit

CPU - Central Processing Unit

Memory

Floppy Disk

Hard Disk

Mouse

Keyboard

• during this lesson, it is helpful to have the various parts and pass them around the class for a real hands-on experience

TIME: 5 minutes

• List some other uses for computers or items which use computers which we have not already discussed in class. Try to come up with at least 4 other uses or items. Make sure you explain why you think it is a computer and explain what the computer is doing.

Good Examples of Computers:

- performs a sequence of instructions (or a program)
- calculates or processes information

calculator, digital watch (alarm, date), cash register, telephone (automatic dialing, accessing information), furnace thermostat (temperature up during the day and down during the night), electric piano, scoreboard (like at Maple Leaf Gardens), exercise equipment display (rowing machine, bike), bank machine (teller machine, cash machine), airplane (automatic pilot), car (brakes, fuel and air mixing), guided missile (steering)

Possible Examples of Computers: (sometimes they can be)

TV (channel selection, picture-in-picture, special effects), washer / dryer / dishwasher (automatic cycles), tape player (special effects), sewing machine (special stitches), oven (timer), radio (station tuning), electronic typewriter (type in a whole line, correct it, then it prints on the paper)

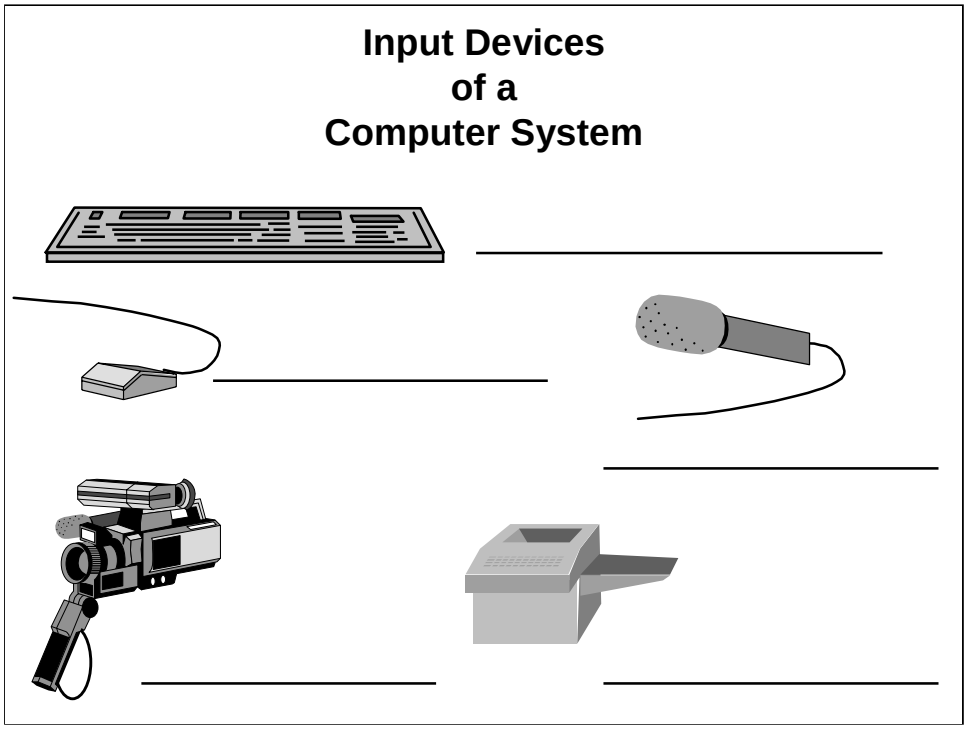
Examples of Computers - NOT:

toaster, refrigerator, wheel chair, electric doors, manual or electric typewriter, projector

- on/off switch, or push buttons controlling a machine does not make it a computer

TIME: 20 minutes

• List some other uses for computers or items which use computers which we have not already discussed in class. Try to come up with at least 4 other uses or items. Make sure you explain why you think it is a computer and explain what the computer is doing.



TIME: 15 minutes

• discuss “input”: putting information into a computer

• ask the question “Can you name some input devices of a computer system?”

-as the class comes up with items, discuss what they are and write them on the board as appropriate

• after the basics are listed, hand out the diagram and work through filling it in:

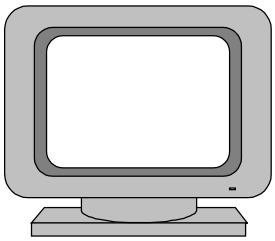
Keyboard

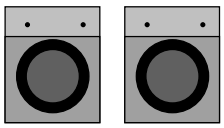
Mouse

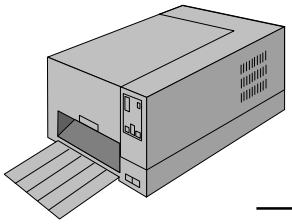
Microphone

Camera Scanner

Output Devices of a Computer System







TIME: 10 minutes

- discuss “output”: getting information out of a computer
- ask the question “Can you name some output devices of a computer system?”

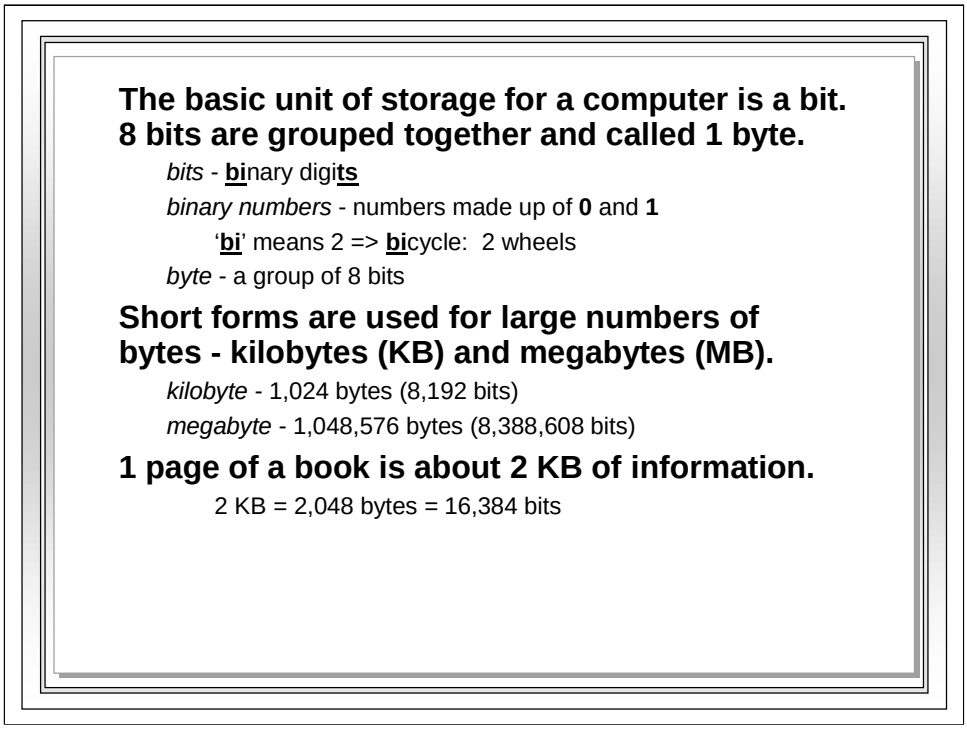
  -as the class comes up with items, discuss what they are and write them on the board as appropriate

- after the basics are listed, hand out the diagram and work through filling it in:

  Display

  Speakers

  Printer



TIME: 20 minutes

- discuss "computer information": bits, bytes, kilobytes, megabytes
  -sizing: 1 page from a book = 2K bytes of information
- discuss "storage": saving [writing] and retrieving [reading] information
  -temporary or permanent
- start the storage device discussion with floppy disks

TIME: 5 minutes

• Complete last week's home work:

List some other uses for computers or items which use computers which we have not already discussed in class. Try to come up with at least 4 other uses or items. Make sure you explain why you think it is a computer and explain what the computer is doing.

• Write notes on the parts parts of a computer, input devices, and output devices.

• Make a list of 3 topics which you would like to explore during these classes.

TIME: 10 minutes

• Complete last week's home work:

List some other uses for computers or items which use computers which we have not already discussed in class. Try to come up with at least 4 other uses or items. Make sure you explain why you think it is a computer and explain what the computer is doing.

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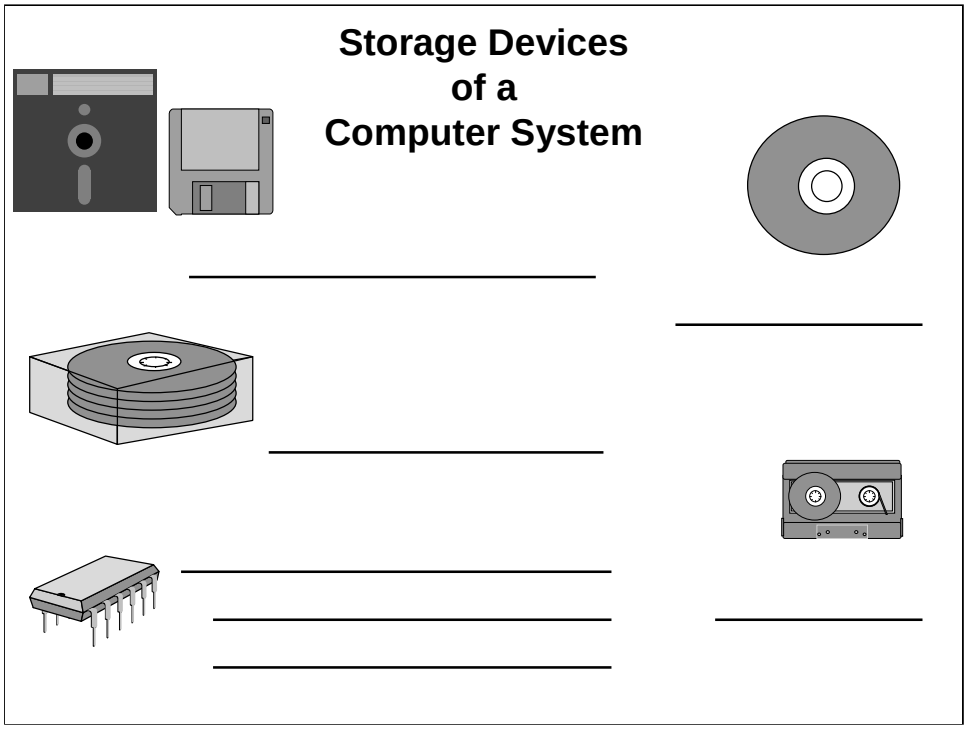


TIME: 60 minutes

• ask the question “Can you name some storage devices of a computer system?”

-as the class comes up with items, discuss what they are, touch them, and write them on the board as appropriate (include size, speed, random or sequential access)

• after the basics are listed, hand out the diagram and work through filling it in:

Floppy Disk (600 - 700 pages, slow, random access)

CD-ROM

(300,000 pages, slow, random)

Hard Disk (40,000 - 600,000+ pages, fast, random)

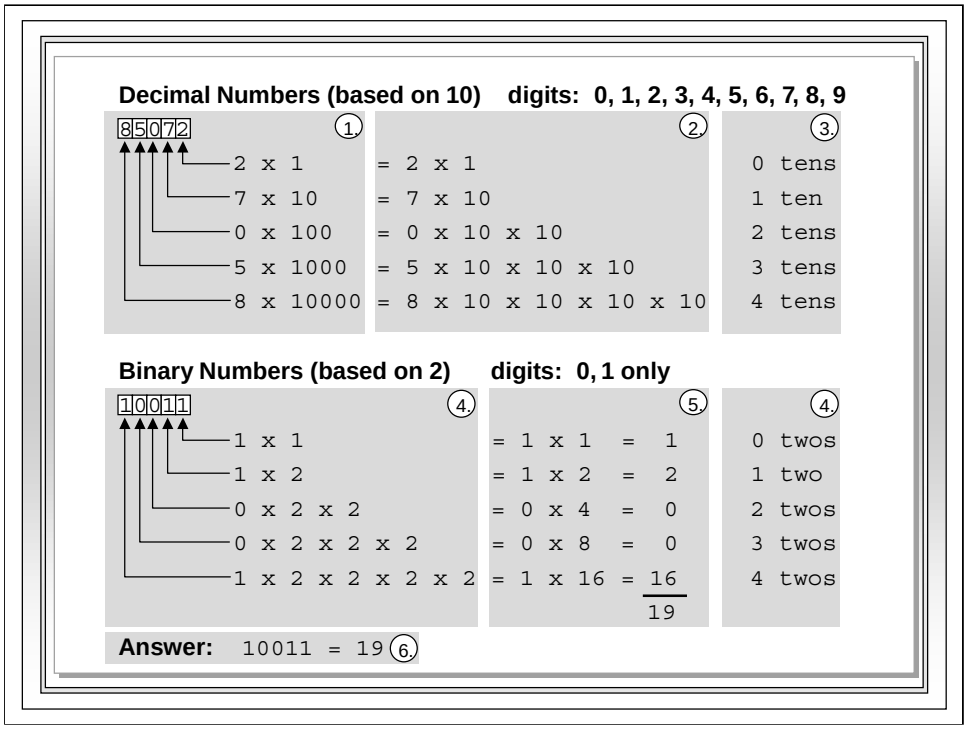
Tape

(25,000 -2,500,000 pages, slow, sequential)

Memory Chips

RAM (2,000 - 8,000 pages, fast, random)

ROM (250 pages, fast, random)



TIME: 30 minutes

• review decimal numbers, introduce binary numbers, convert a binary number to a decimal number - follow steps 1. through 6. in order

• do the following questions with the class:

0 0 1 1 1

1 x 1 = 1
1 x 2 = 2
1 x 4 = 4
0 x 8 = 0
0 x 16 = 0

Answer: 00111 = 7

0 1 0 1 1

1 x 1 = 1
1 x 2 = 2
0 x 4 = 0
1 x 8 = 8
0 x 16 = 0

Answer: 01011 = 11

1 0 1 0 0

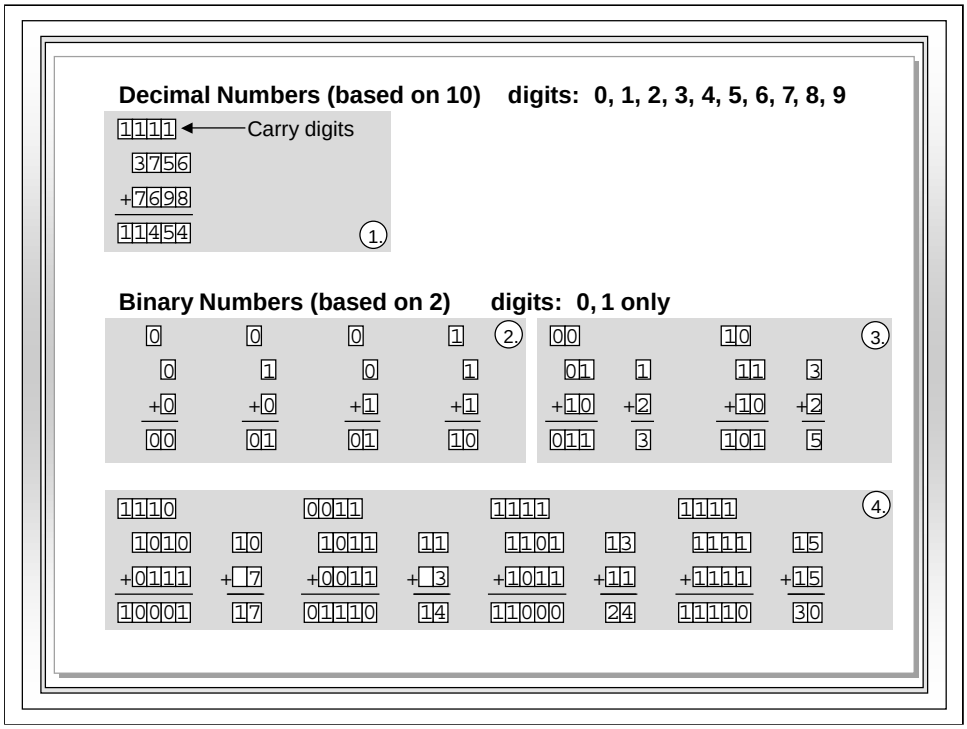
0 x 1 = 0
0 x 2 = 0
1 x 4 = 4
0 x 8 = 0
1 x 16 = 16

Answer: 10100 = 20

1 1 0 1 1

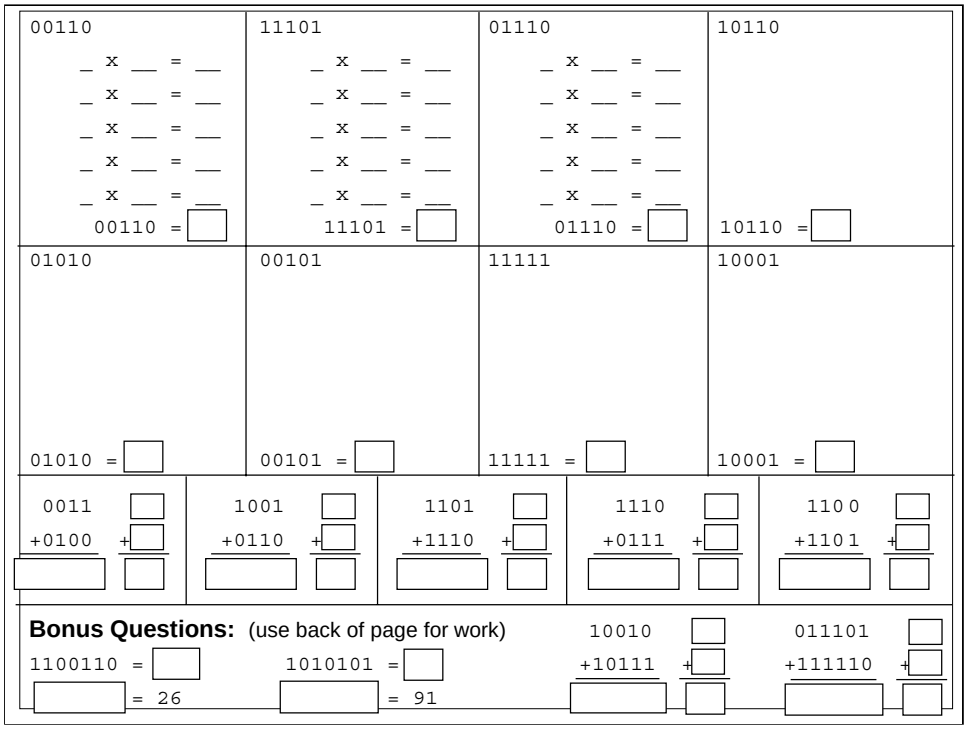
1 x 1 = 1
1 x 2 = 2
0 x 4 = 0
1 x 8 = 8
1 x 16 = 16

Answer: 11011 = 27



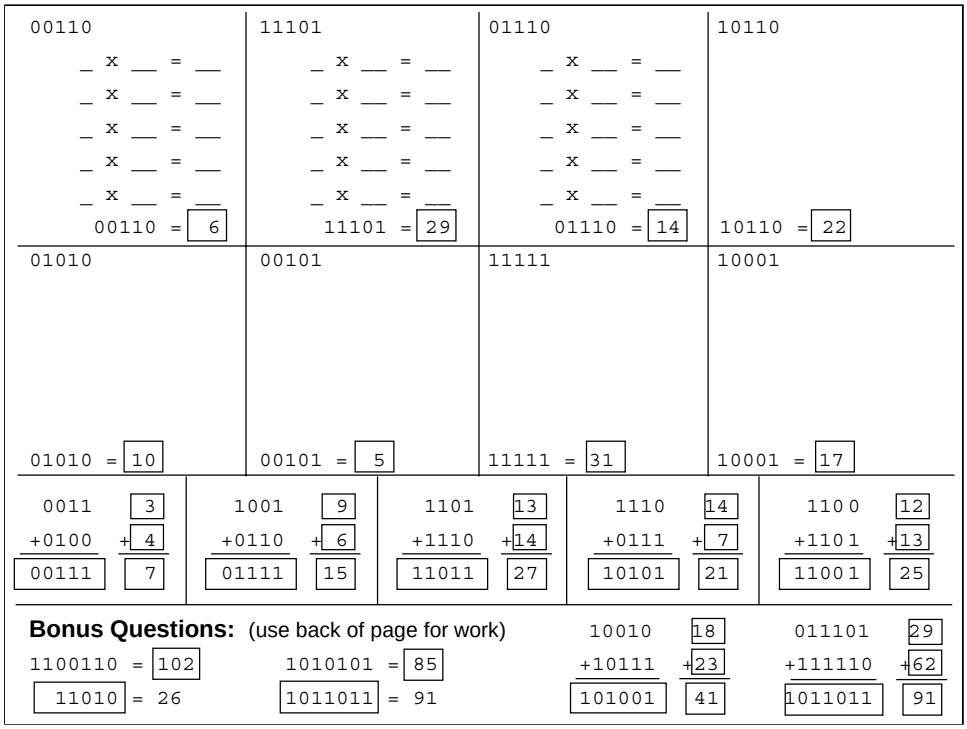
TIME: 30 minutes

• review adding decimal numbers, introduce adding binary digits, then adding binary numbers - follow steps 1. through 4. in order



TIME: 10 minutes

- Convert the 5 bit binary numbers to decimal numbers
- Add the two 4 bit binary numbers
  and convert the question to decimal numbers
- Bonus questions:
  - Convert the 7 bit binary numbers to decimal numbers
  - Convert the decimal numbers to binary numbers
  - Add the two 5 bit binary numbers
    and convert the question to decimal numbers
  - Add the two 6 bit binary numbers
    and convert the question to decimal numbers



TIME: 10 minutes

- Convert the 5 bit binary numbers to decimal numbers
- Add the two 4 bit binary numbers
  and convert the question to decimal numbers
- Bonus questions:
  - Convert the 7 bit binary numbers to decimal numbers
  - Convert the decimal numbers to binary numbers
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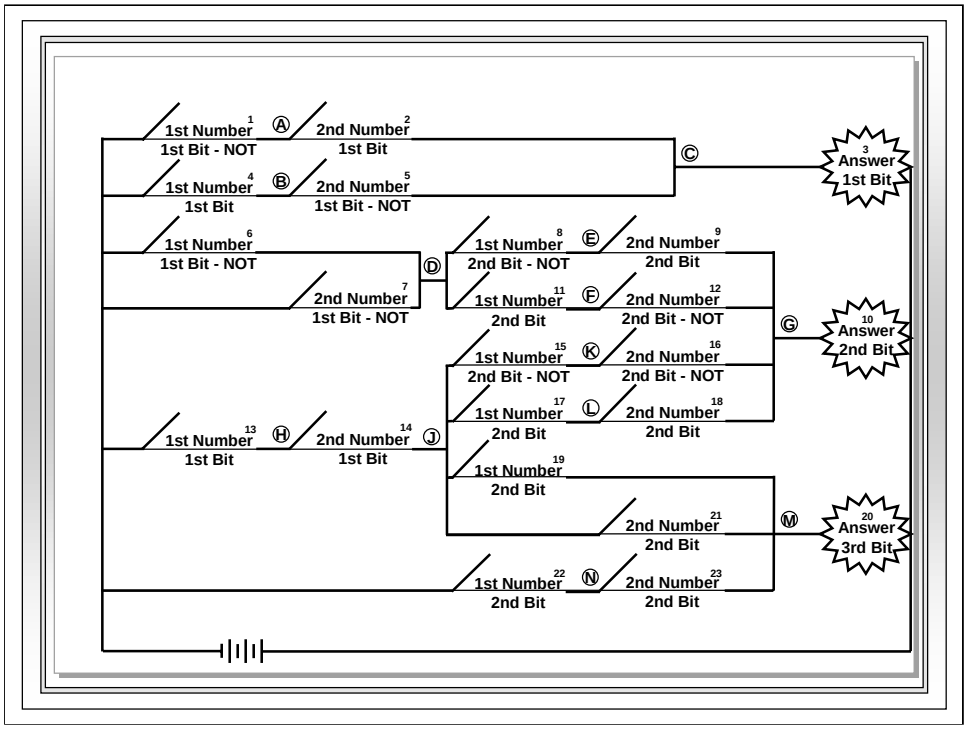


TIME: 55 minutes

• Construct the “human computer” according to the circuit above to add two 2 bit binary numbers

  • hand out the switch labels and answer bit labels to the class (20 switches + 3 answer bits)

  • line everyone up so that people with no input are first, followed by each input/output pair in line (each label identifies the input and output connections)

  • each regular switch should be ON (arms forward and backward) if the specified bit is ‘1’ and OFF (arms left and right) if the specified bit is ‘0’

  • each NOT switch should be OFF (arms left and right) if the specified bit is ‘1’ and ON (arms forward and backward) if the specified bit is ‘0’

  • if two switches, which are in line, are both ON, then join hands to complete the circuit

  • if the circuit is completed to an answer bit, then that person should have joined one hand with the input and then raise the other hand indicating that the bit of the answer is ‘1’ (otherwise the bit of the answer is ‘0’)

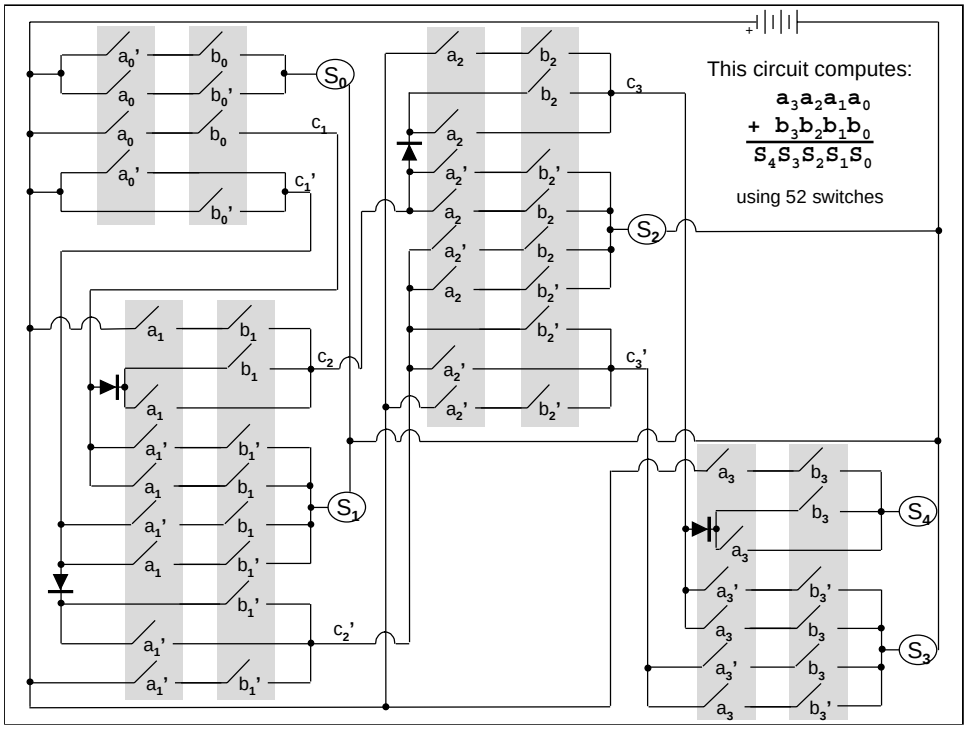
  • assign people to write down the questions and answers

• Try as many of the following questions as there is time for:

01	01	01	10	10	10	11	11	11
+01	+10	+11	+01	+10	+11	+01	+10	+11
010	011	100	011	100	101	100	101	110

TIME: 5 minutes

- Complete last week's home work



TIME: 20 minutes

- Demonstrate the switch box computer
- Complete last week's home work
    - check and correct the home work using the switch box computer

How does a computer work?

- a circuit of switches can perform specific instructions like adding 2 numbers

  "A computer is a machine which follows a set of instructions to perform calculations or to store, process, and retrieve information."

- the basic instructions that a computer understands are made up of circuits just like the one we made
- types of switches:
  - mechanical • tubes • transistors • *IC* - integrated circuits

CPUs

- basic data size 8, 16, 32 bits
  - NES 8 bit • SNES 16 bit • Sega 16 bit

Year	Name	Instructions Performed in 1 Second	Switches (Transistors)	Data Size
1971	4004	60,000	2,300	4 bits
1978	8086	750,000	29,000	16 bits
1982	286	2,600,000	134,000	16 bits
1985	386	11,400,000	275,000	32 bits
1989	486	41,000,000	1,200,000	32 bits
1993	Pentium	100,000,000	3,100,000	64 bits
1997	Pentium II	470,000,000	7,500,000	64 bits
1999	Pentium III	1,300,000,000	28,000,000	64 bits

TIME: 50 minutes

- Review what we did over the last 2 weeks
  - we learned how computers represent numbers

    '1' bit means 'ON' or 'electricity **is** flowing'

    '0' bit means 'OFF' or 'electricity **is not** flowing'
  - we demonstrated that a circuit of switches can add 2 numbers
  - the basic instructions that a computer understands are made up of circuits just like the one we made
- Show evolution of switches:

  mechanical (origin of *computer bug*), vacuum tubes

  transistors, *IC* - integrated circuits
- Explain basic data size using video game examples
  - show how game cartridges plug into bus using I/O card & motherboard
- List evolution of CPUs

20 switches to add 2 2-bit numbers, 52 switches to add 2 4-bit numbers

How does a computer store numbers?

- binary

How does a computer store letters (characters)?

- ASCII codes (numbers)
- each letter has a code (a number from 0 to 127)
  'A' is code 65, 'e' is code 101, '5' is code 53
- my name is:

```
77 114  46  83  99 104 110 101 105 100 101 114
 M   r   .   S   c   h   n   e   i   d   e   r
```

TIME: 70 minutes

- Review how computers store numbers
- Describe ASCII encoding and hand out ASCII table
- Describe space ('sp'), carriage return ('\r'), new line ('\n')
- Decode the following message

```
 G   o   o   d       m   o   r   n   i   n   g
71 111 111 100  32 109 111 114 110 105 110 103
 !  \r  \n   W   e   l   c   o   m   e       t
33  13  10  87 101 108  99 111 109 101  32 116
 o  \r  \n   C   o   m   p   u   t   e   r   s
111 13  10  67 111 109 112 117 116 101 114 115
     a   n   d       T   e   c   h   n   o   l
32  97 110 100  32  84 101  99 104 110 111 108
 o   g   y   .
111 103 121  46
```

- Have everyone encode their name