INDEX

Number Systems

COMPUTERS 2

What is the binary (base-2) representation of $(135)_{10}$?

(A) 101111010
(B) 010111101
(C) 010000111
(D) 101111001

Solution:

$$
\begin{aligned}
(135)_{10} &= 1 \times 2^7 \\
&+ 0 \times 2^6 \\
&+ 0 \times 2^5 \\
&+ 0 \times 2^4 \\
&+ 0 \times 2^3 \\
&+ 1 \times 2^2 \\
&+ 1 \times 2^1 \\
&+ 1 \times 2^0
\end{aligned}
$$

$$(135)_{10} = 10000111_2$$

Answer is C.

COMPUTERS 3

What is the base-10 equivalent of the binary number 0101110?

(A) 18
(B) 30
(C) 46
(D) 47

Solution:

$$
\begin{aligned}
& 0 \times 2^6 \\
+ \; & 1 \times 2^5 \\
+ \; & 0 \times 2^4 \\
+ \; & 1 \times 2^3 \\
+ \; & 1 \times 2^2 \\
+ \; & 1 \times 2^1 \\
+ \; & 0 \times 2^0 = 46
\end{aligned}
$$

Answer is C.

COMPUTERS 5

What is the octal (base-8) equivalent of the binary number $(1101101)_2$?

(A) $(109)_8$
(B) $(155)_8$
(C) $(550)_8$
(D) $(660)_8$

Solution:

Since $8 = (2)^3$, separate the bits into groups of three bits, starting with the least significant bits. Add leading zeros if necessary for consistency.

001 101 101

Convert each group of three bits into its octal equivalent.

001	101	101
$(1)_8$	$(5)_8$	$(5)_8$

The octal equivalent is 155. Answer is B.

COMPUTERS 2

What is the two's complement of $(-14)_{10}$?

(A) 10010
(B) 01101
(C) 11011
(D) 01111

Solution:

$14_{10} = (0 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + 0$

$(14)_{10} = (01110)_2$

Standard way to find two's complement is to flip all the bits, then add 1.
Flipping all of the digits: 10001

Adding 1: 10001+ 1 =10010

Answer is A.

COMPUTERS 3

Given that the base-2 representation of 143 is 10001111, what could be the base-2 representation of -143 in a 9-bit machine?

(A) 010001111
(B) 001000101
(C) 001110000
(D) 101110000

Solution:

One method of indicating a negative number is to use the most-significant bit as a flag. This is called sign magnitude where the 1 typically indicates a negative number and the 0 indicates a positive number. The remaining bits are reversed.

Answer is D.

COMPUTERS 4

What is the binary (base-2) representation of the hexadecimal (base-16) number $(7704)_{16}$?

(A) 0101 1011 0000 0100
(B) 0110 0111 0000 0100
(C) 0111 0011 0000 0100
(D) 0111 0111 0000 0100

Solution:

Since $16 = (2)^4$ each hexadecimal digit will expand into four bits.

$(7)_8 = (0111)_2$

$(7)_8 = (0111)_2$

$(0)_8 = (0000)_2$

$(4)_8 = (0100)_2$

Combine the bits.

0111 0111 0000 0100

Answer is D.

COMPUTERS 4

What is the one's complement of $(10101)_2$?

(A) 00010
(B) 01010
(C) 10010
(D) 10001

Solution:
The one's complement is found by switching all of the ones and zeros.
Answer is B.

COMPUTERS 5

What is the binary equivalent of the base-5 number $(213144)_5$?

(A) 0 1101 1001 0101
(B) 1 0011 0111 1100
(C) 1 0111 0110 1101
(D) 1 1100 1000 0011

Solution:

Convert the base-5 number to base-10.

$$(213144)_5 = (2 \times 5^5) + (1 \times 5^4) + (3 \times 5^3) + (1 \times 5^2) + (4 \times 5^1) + (4 \times 5^0)$$
$$= 6250 + 625 + 375 + 25 + 20 + 4$$
$$= (7299)_{10}$$

Then convert the base-10 number to base-2.

$$(7299)_{10} = (1 \times 2^{12}) + (1 \times 2^{11}) + (1 \times 2^{10}) + (0 \times 2^9) + (0 \times 2^8) + (1 \times 2^7) + (0 \times 2^6)$$
$$+ (0 \times 2^5) + (0 \times 2^4) + (0 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)$$

The base-2 equivalent is 1 1100 1000 0011.

Answer is D.

Definitions

COMPUTERS 6

Which of the following best defines a buffer?

(A) a region where extra information goes once the main memory is full
(B) a temporary storage region used to compensate for signal time differences
(C) the same thing as main memory
(D) a permanent memory region where start-up information is stored

Solution:

A buffer is a temporary storage region that holds data until it is used.
Answer is B.

COMPUTERS 7

Which of the following best defines a bit?

(A) a basic unit of a computer used to encode a single character of text
(B) the smallest portion of computer memory that can represent a distinct computer address
(C) a binary digit that represents one possible value or state
(D) computer memory that can represent one of two possible values or states

Solution:

A binary digit (i.e., a bit) can be in one of two possible states. Answer is C.

COMPUTERS 8

Which of the following best defines a micro-operation?

(A) the complex operations that are performed by the CPU during one micro-second
(B) an elementary operation performed on information stored in one or more registers during one clock pulse
(C) an operation that takes the smallest amount of time to execute
(D) an elementary operation performed on information stored in one or more registers during one cycle

Solution:

A micro-operation is an action that is taken during one clock cycle.

Tough question. Many microprocessors are actually programmed in microcode, i.e. even simpler instructions which the CPU executes but which the programmer cannot see. As a result a micro-operation is one of these micro-instructions and is executed during one clock cycle.

Answer is B.

COMPUTERS 9

Which of the following best defines a compiler?

(A) hardware that is used to translate high-level language to machine code
(B) software that collects and stores executable commands in a program
(C) software that is used to translate high-level language into machine code
(D) hardware that collects and stores executable commands in a program

Solution:

A compiler is a program (i.e., software) that converts programs written in higher-level languages to low-level instructions that the computer can understand.

Answer is C.

COMPUTERS 22

Which of the following terms is not a synonym for the others?

I. bps
II. baud
III. bits per second
IV. cps

(A) I only
(B) II only
(C) III only
(D) IV only

Solution:

bps, bits per second, and baud are all synonymous. cps is the abbreviation for cycles per second or characters per second.

Answer is D.

COMPUTERS 12

Which of the following best defines a nibble?

(A) half a byte of memory
(B) a read-only operation (without any change in memory)
(C) a CPU operation that is performed in half a clock cycle
(D) a CPU operation that is performed in one clock cycle

Solution:

A nibble is a block of four contiguous bits (i.e., half a byte).

Answer is A.

Note: The following are not well-written questions in my opinion, but I took them from a popular EIT review book. Their only use should be to understand what the underlined terms mean. The alternative definitions in the answers are not always bad answers, and sometimes none of them are correct.

COMPUTERS 6

Which of the following best defines a byte?

(A) eight bits typically used to encode a single character of text
(B) the smallest number of bits that can be used in arithmetic operations
(C) the basic unit of information accessed by a computer
(D) a binary digit that represents one of two equally accessible values or states

Solution:
A byte is a group of eight bits. A byte can store a single character or command.
Answer is A.

Not a well written question. A byte is typially defined as 8 bits of information. It is the basic unit of information used by a computer, and can be used in representing data (such as an 8-bit character) as well as short integers or even an instruction in a 8-bit machine.

COMPUTERS 7

Which of the following best defines a word?

(A) the equivalent of four bytes; the basic unit of data transfer
(B) the largest number of bytes that can be used in arithmetic operations
(C) eight contiguous bits in computer memory
(D) the smallest number of bytes that can be used in arithmetic operations

Solution:
Computer words are the smallest memory units that can be manipulated in arithmetic operations.
Answer is D.

Not a well written question. A word is typially defined as 16 bits, or 2 bytes, of information. It is the size typically used for arithemetic operations (especially integers) although byte arithmetic is also encountered, especially in microcomputers.

COMPUTERS 11

Which of the following best describes a direct memory access process?

(A) the address of the address of the operand is specified in the instruction
(B) the address of the operand is specified in the instruction
(C) the operand itself is specified as part of the instruction
(D) the operand address is the same as the register and base addresses

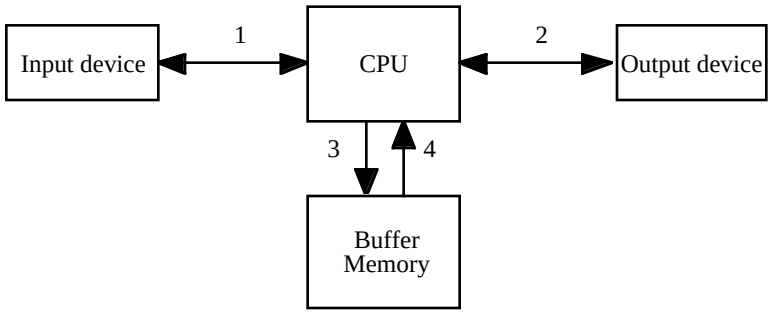
Solution:
Answer is B. This is a very poorly worded instruction.

I don't think any answer is really correct. The three basic types of computer i/o are (1) polled, (2) interrupt driven, and (3) DMA. In a DMA operation the data transfer is directly from peripheral to peripheral, i.e., control of the bus is transferred to the peripheral device. An example of this might a high speed A/D converter which takes control of the bus and transfers input data directly to memory. The CPU is not directly involved in the process at all.

Computer Architecture

COMPUTERS 8

Which data transfer path(s) is (are) used the most in typical computer operations?



(A) 1
(B) 2
(C) 3
(D) 3 and 4

Solution:

Input and output devices (e.g., keyboards and printers) are used far less frequently than memory-transfer operations. Data enters and is read (i.e., or is replaced) in buffer memory at approximately the same rates.

Answer is D.

COMPUTERS 10

A 256K-word memory uses 16 bit-words. How many parallel data lines are required to pass data to the CPU for processing?

(A) 2
(B) 8
(C) 9
(D) 16

Solution:

All of the bits in a word are passed in parallel to the CPU. There is one data line per data bit.

Answer is D.

COMPUTERS 12

How does a CPU know whether it is executing instructions from a commercial database management program or from a program executing from an on-line programmer'?

(A) The micro-operations used are different for the two programs.
(B) One of the programs uses memory references while the other uses register references.
(C) One of the programs uses compiled code while the other uses interpreted code.
(D) The CPU doesn't know where instructions originate.

Solution:

A CPU executes micro-operations regardless of their origins.

Answer is D.

COMPUTERS 15

A simple controller board has two thousand 8-bit memory locations and two 8-bit registers. How many different states can this board be in?

(A) 2002
(B) $(2)^{8}$
(C) $(2)^{2002}$
(D) $(2)^{16,016}$

Solution:

The number of bits in the memory and registers is (8)(2000 + 2) = 16,016
Each bit can take on 2 different **values.** The number of different states is $(2)^{16,016}$

Answer is D.

COMPUTERS 18

How long will it ideally take to transmit a 400k (byte) text file using a 28.8k modem in simplex mode?

(A) 1 min
(B) 2 min
(C) 11 min
(D) 14 min

Solution:

The number of bits to be transmitted is

(400 Kbytes) (1000 bytes/Kbytes) (8 bits/byte) = 3,200,000 bits

The modem transmits at 28,800 bits/sec. In simplex mode, transmission is in one direction only. The time required is

t = 3,200,000 bits/[(28,800 bits/sec)(60 sec/min)] = 1.85 min (~2 min)

Answer is B.

COMPUTERS 19

How many 8-bit bytes are in 2 MB of memory?

(A) 16,000
(B) 16,256
(C) 2,000,000
(D) 2,097,152

Solution:

MB stands for "megabyte," roughly a million bytes. The actual number of bytes in a megabyte is

$(2)^{20} = 1{,}048{,}576$
$(2)(1{,}048{,}576) = 2{,}097{,}152$

Answer is D.

COMPUTERS 20

Which of the following types of memory is lost when the power is removed?

(A) RAM
(B) ROM
(C) PROM
(D) EPROM

Solution:

ROM (read-only memory), PROM (programmable read-only memory), EPROM (erasable, programmable read-only memory), and WORM (write-once, read many) devices retain their information when the power is removed.

Answer is A.

COMPUTERS 21

A hard disk drive with three 2 in (diameter) platters turns at 3000 rpm. What is the average latency for the drive?

(A) 0.003 sec
(B) 0.001 sec
(C) 0.02 sec
(D) 0.04 sec

Solution:

Latency is the rotational delay (i.e., the time it takes for the information needed to appear under the read-write head. On the average, latency is one-half of the time to turn a full revolution.

latency = 1/2 * [(60 sec/min)/(3000 rev/min)] = 0.01 see

Answer is B.

Boolean Logic

COMPUTERS 10

What is the correct simplified expression for the Boolean expression $\overline{A}\overline{B}\overline{C} + \overline{A}BC$?

(A) 1
(B) $\overline{A}\left(\overline{B}\overline{C} + BC\right)$
(C) A
(D) BC

Solution:
Choice (B) follows directly from Boolean operations. The resulting expression cannot be simplified any more without knowing the actual values of A, B, and C.

Answer is B.

COMPUTERS 13

Given A = true, B = true, and C = false, what is the value of the following logical expression?

(A.AND.B).AND.(NOT.(C.OB.A))

(A) true
(B) false
(C) either true or false
(D) neither true nor false

Solution:

Evaluate the terms within the parentheses first.

(A.AND.B) = true.AND.true = true
(C.OR.A) = false.OR.true = true
(NOT.(C.OR.A)) = NOT.true = false
(A.AND.B).AND.(NOT.(C.OR..A)) =- true.AND.false = false

This problem can also be done with zeros and ones.

Answer is B.

COMPUTERS 13

What is the equivalent expression for the Boolean expression ($\overline{AB}$)?

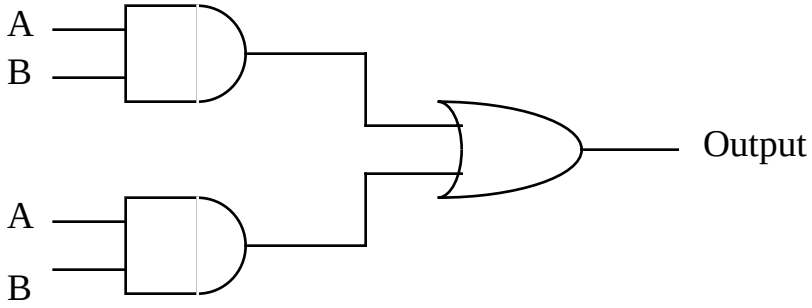
(A) A + B
(B) $\overline{A} + \overline{B}$
(C) AB
(D) either $\overline{A} + B$ or $A + \overline{B}$

Solution:

Choice (B) is a direct result of De Morgan's law. Answer is B.

COMPUTERS 14

A and B are inputs to two logic gates, as shown. What is the output?



(A) AB + AB
(B) AB
(C) A + B
(D) always 0

Solution:

Two AND gates are shown. The output from each gate is AB. The outputs of the two gates are combined in an OR operation. The output of the OR gate is then

AB + AB

This will be equal to 0 if (AB) is 0; it will be equal to 1 if (AB) is 1.

Answer is A.

Spreadsheets

COMPUTERS 17

The cells in a computer spreadsheet program are as shown.

	A	**B**	**C**	**D**
1	4	-1	3	0
2	3	A3+C1	-3	6
3	.5	m	33	2
4	Smith	1	B2*B3	C4

Instructions in macro-commands are scanned from left to right. What is the value of n in the following macro-commands?

```
m = 55
p = m * 2 + 6
n = D4 - 3 * p * *0.5
```

(A) 4
(B) 5.5
(C) 10.5
(D) 1041

Solution:
Evaluate the macro using the following typical precedence rules:

- exponentiation before multiplication and division
- multiplication and division before addition and subtraction
- operations inside parentheses before operations outside

m = 5

p = m * 2 + 6 = (5 * 2) + 6 = 16

n = D4 - 3 * p * *0.5

= C4 - 3 * p * *0.5

= B2 * B3 - 3 * p * *0.5

= (A3+Cl)*m - 3*p**0.5

= ((0.5 + 3) * 5) - (3) * (16) * *(0.5)

= ((3.5) * 5) - (3) * (16) * *(0.5)

= ((3.5) * 5) - 12

= 17.5 - 12

= 5.5

Answer is B.

COMPUTERS 55

In a spreadsheet, the number in cell A4 is set to 6. Then A5 is set to A4 + $A$4 where $ indicates absolute cell address. This formula is copied into cells A6 and A7. The number shown in cell A7 is most nearly:

(A) 12
(B) 24
(C) 36
(D) 216

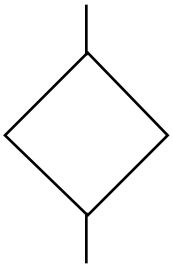
	A	B
1		
2		
3		
4	6	
5	A4+$A$4	
6	A5+$A$4	
7	A6+$A$4	

A5=A4+$A$4=6+6=12
A6=A5+$A$4=12+6=18
A7=A6+$A$4=18+6=24
Answer is (B)

Flowcharts

COMPUTERS 11

What operation is typically represented by the following program flowchart symbol?



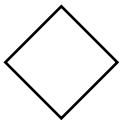
(A) input-output
(B) processing
(C) storage
(D) branching

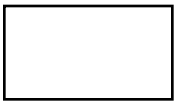
Solution:

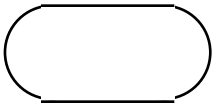
Branching, comparison, and decision operations are typically represented by the diamond symbol.

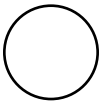
Answer is D.

16. Which of the following program flowchart symbols is typically used to indicate the end of a process or program?

(A) 

(B) 

(C) 

(D) 

Solution:

Termination (end of the program) is commonly represented by the symbol in choice (C).

Answer is C.

Software

COMPUTERS 9

Which of the following operations is probably not an instruction in a low-level (e.g., assembly language) programming language?

(A) AND
(B) FETCH
(C) LDA
(D) STOP

Solution:

AND, FETCH, LDA (load register A), and CLA (clear register A) are typical assembly language commands. STOP is used in higher-level programming languages to indicate the logical termination of an algorithmic process. If stop appears in an assembly language program it is a assembler directive and NOT an instruction of the microprocessor. Be careful — some microprocessors have SLEEP instructions which are not the same as a STOP.

Answer is D.

COMPUTERS 56

The program segment

```
INPUT Z,N
S=1
T=1
FOR K=1 TO N
T=T*Z/K
S=S+T
NEXT K
```

calculates the sum:

(A) $S = 1 + ZT + 2ZT + 3ZT + ... + nZT$
(B) $S = 1 + ZT + ZT/2 + ZT/3 + ... + ZT/n$
(C) $S = 1 + Z/1 + Z^2/2 + Z^3/3 + ... + Z^n/n$
(D) $S = 1 + Z/1! + Z^2/2! + Z^3/3! + ... + Z^n/n!$

The key thing here is what the FOR loop does.

For K=1, $T=1*Z/1=Z$
For K=2, $T=T*Z/K = Z * Z/2 = Z^2/2$
For K=3, $T=T*Z/K = Z^2/2 * Z/3 = Z^3/6$

The S=S+T simply sums the terms. This series is proceeding as (D).

COMPUTERS 23
How many times will the second line be executed?

```
                M = 42
LOOPSTART       M = M - 1
                P = INTEGER PART OF (M/2)
                IF P > 15, THEN GO TO
                     LOOPSTART, OTHERWISE
                     GO TO END
END             PRINT "DONE"
```

(A) 8
(B) 9
(C) 10
(D) 11

Solution:

The values of the variables for each iteration are

iteration	m	p
1	41	20
2	40	20
3	39	19
4	38	19
5	37	18
6	36	18
7	35	17
8	34	17
9	33	16
10	32	16
11	31	15

When P reaches 15, P is no longer greater than 15. Line 2 is executed 11 times.

Answer is D.

COMPUTERS 54
The flowchart for a computer program contains the following segment:

```
VAR=0
IF VAR<5 THEN VAR=VAR+2
RETURN
```

What is the value of VAR at the conclusion of this routine?
(A) 0
(B) 2
(C) 4
(D) 6

ANSWER: Since VAR=0 THEN VAR=0+2 at the end of the second statement. As the following statement is a RETURN, we will then have (B) VAR=2.

COMPUTERS 26

The numbers -3, 5, 2, -6, -1, 3, ... are in a file to be read and processed by the pseudocode shown below. The number after the pseudocode is executed is most nearly:

```
Set I=1 and Y=0
While I<=3
        Read a value from the file and set X equal to that value
        If X<0 go to 1
        else Y=Y+X*X
1       Increment I by 1
EndWhile
Z=Y/I
```

(A) 7.3
(B) 9.7
(C) 19.5
(D) 26.0

ANSWER:
Poorly written question. It doesn't even tell you what variable the question is referring to. Z?

```
I=1, Y=0
BeginWhile
I<=3 so do first iteration of loop
        read and set X=-3
        X<0 so goto 1
        Increment I to 2
I=2 so do another iteration
        read and set X=5
        X not < 0 so Y=Y+X*X = 0+5*5 = 25
        Increment I to 3
I=3 so do another iteration
        read and set X=2
        X not < 0 so Y=Y+X*X = 25+2*2 = 29
        Increment I to 4
EndWhile
Z = Y/I = 29/4 = 7.3
```

ANSWER is (A)