

# Computers

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17-1a

## Terminology

READ—FERM Computer Chapters 47 and 48

## Terminology

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Example (FEIM): Hardware

Which of the following terms is best defined as a device that holds data and instructions for further manipulation?

- (A) buffer
- (B) accumulator
- (C) data bus
- (D) modem

Answers (C) and (D) can be eliminated because these devices pass data and do not hold it. Answers (A) and (B) are both devices that hold data—one holds data before transfer only (the buffer) and one holds data for further processing (the accumulator).

Therefore, the answer is (B).

## Terminology

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Example (FEIM): Software

Which of the following is a seven-bit code for representing characters as digital words?

- (A) binary
- (B) RS-232C
- (C) ASCII
- (D) EPROM

First, read the whole question and think! Binary is a digital code, so if one saw the words “code” and “digital” in the problem statement one might be hasty and answer (A). The RS-232C interface passes digital words, so one might also be hasty and answer (B). However, ASCII is correct.

Therefore, the answer is (C).

## Spreadsheets

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### Cell Reference

- Columns – letter designators
- Rows – number designators

### Absolute Cell Reference

- “absolute” designator – “\$” (placed before the row and column designators; e.g., \$B\$4)

### Absolute Column, Relative Row Cell Reference

- Column reference with a “\$” (e.g., \$B4)

### Relative Column, Absolute Row Cell Reference

- Row reference with a “\$” (e.g., B\$4)

### Relative Cell Reference

- Depends entirely on which cell it is located in (e.g., B4)

## Spreadsheets

Example (FEIM):

In a spreadsheet, the formula  $\$A\$4 + B\$2 + B2$  is entered into cell C3. The contents of cell C3 are copied and pasted into cell D5. The formula in cell D5 is:

- (A)  $\$A\$4 + C\$2 + C4$
- (B)  $\$B\$6 + C\$4 + C4$
- (C)  $\$A\$4 + C\$4 + C4$
- (D)  $\$A\$4 + B\$2 + B2$

The first absolute cell reference is unchanged by the paste operation and remains  $\$A\$4$ .

The second cell reference will have the column reference increased by one and become  $C\$2$ .

The third cell reference will have the column reference increased by one and the row reference increased by two and will become  $C4$ .

Therefore, the answer is (A).

## Spreadsheets

### Example (FEIM): Simple Spreadsheet Calculations

In a spreadsheet, the number in cell A4 is set to 6. Then, A5 is set to  $A4 + \$A\$4$ . 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

$$A5 = A4 + \$A\$4 = 6 + 6 = 12$$

$$A6 = A5 + \$A\$4 = 12 + 6 = 18$$

$$A7 = A6 + \$A\$4 = 18 + 6 = 24$$

Therefore, the answer is (B).

# Computers

17-3a

## Algorithm Flowcharts

Terminal – starts or stops a process

Decision – decision must be made or two items are compared

Input/output – receive, output, or store data

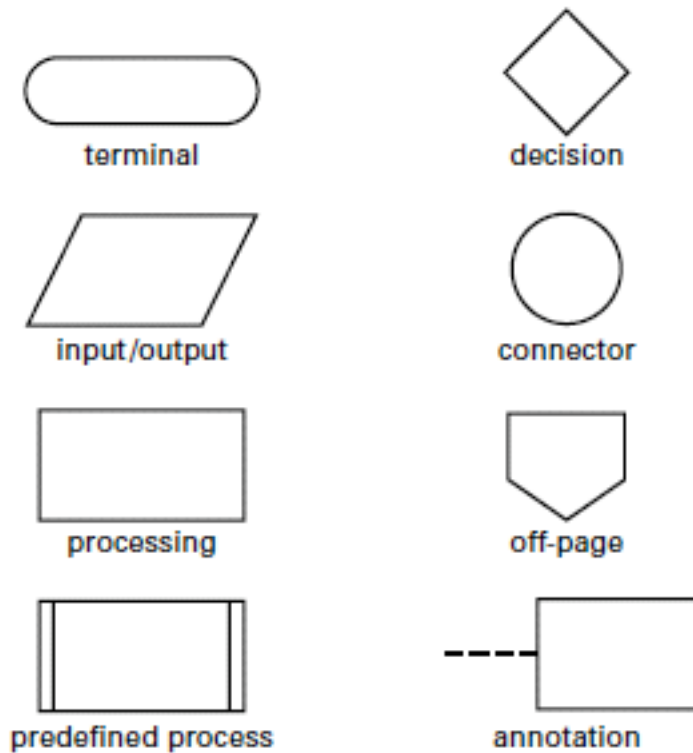
Connector – indicates the flowchart continues elsewhere

Off-page – indicates the flowchart continues on the following page

Processing and predefined process – refer to calculation or data manipulation

Annotation – comments

Figure 48.1 Flowcharting Symbols



## Algorithm Flowcharts

Example 1 (FEIM):

What is the value of X at the completion of the flow diagram shown?

- (A) 2
- (B) 4
- (C) 5
- (D) none of these

In the first pass, the program performs the operation

$$X = T + 1 = 3 + 1 = 4$$

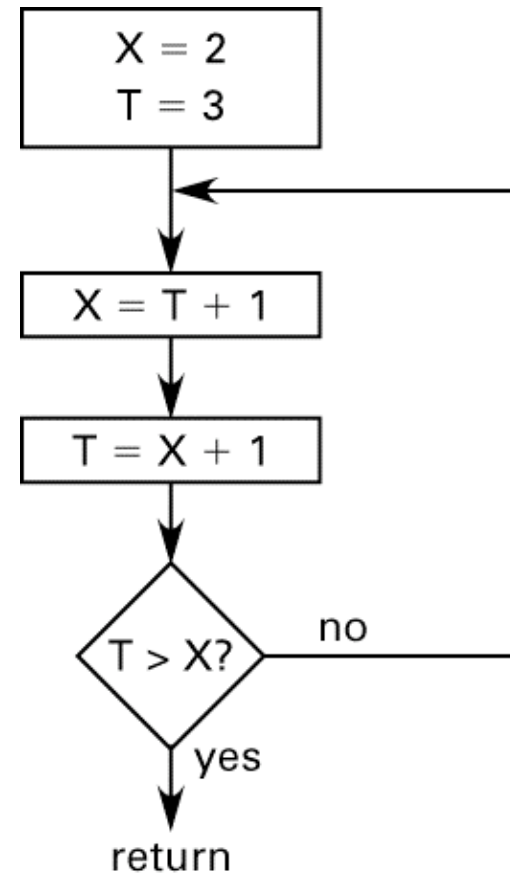
Now,  $X = 4$ , so the next operation is

$$T = X + 1 = 4 + 1 = 5$$

Since the condition  $T > X$  is now satisfied, the program segment is over and  $X = 4$ .

Therefore, the answer is (B).

NOTE: “=” indicates *replacement* not equality (in FORTRAN and on the FE Exam)



## Structured Programming

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### Simple Calculations

+        add  
-        subtract  
\*        multiply  
/        divide  
^ or \*\*  exponentiation

Sequence of open operations from left to right in the following hierarchy:  
exponentiation, then  
multiplication and division, then  
addition and subtraction

Examples of how  $X^B$  might be expressed:

$X^{**}B$

$X^B$

## Structured Programming

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Example (FEIM):

A computer structured programming program contains the following calculation. What is the value of X?

$$X = (4*6)/(5-3)$$

- (A) 12
- (B) 20
- (C) 24
- (D) 40

The quantities in the parentheses are calculated first, so the values are  $24/2 = 12$

Therefore, the answer is (A).

## Structured Programming

### IF-THEN Statements

- IF <condition> THEN <action>
- IF <condition> THEN <action 1> ELSE <action 2>

Example (FEIM):

A computer structured programming program contains the following program segment. What is the value of X after the segment is executed?

X = 2

T = 3

IF  $X * 2 > T$  THEN  $T = X * 2$

IF  $T > X$  THEN  $X = T * 2$

IF  $T < X$  THEN  $X = T + 3$

- (A) 2
- (B) 6
- (C) 7
- (D) 11

## Structured Programming

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Since  $X * 2 = (2)(2) = 4$ , the condition is satisfied, and the operation is performed:

$$T = X * 2 = (2)(2) = 4$$

Since  $X = 2$  and  $T = 4$  now, the second operation is performed:

$$X = T * 2 = (4)(2) = 8$$

Since  $X = 8$  and  $T = 4$  now, the third operation is performed:

$$X = T + 3 = 4 + 3 = 7$$

Therefore, the answer is (C).

## Structured Programming

### GOTO Operations

These operations move the program to a number designator.

Example (FEIM):

A computer structured programming program contains the following program segment. What is the value of X after the segment is executed?

X = 4

T = 8

1 T = T - 1

X = X + 1

IF X < T THEN GOTO 1

(A) 6

(B) 7

(C) 9

(D) 11

## Structured Programming

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The first and second operations are performed, so

$$T = 8 - 1 = 7$$

$$X = 4 + 1 = 5$$

Since  $X < T$ , the GOTO operation is executed and the program returns to line 1.

The first and second operations are performed again, so

$$T = 7 - 1 = 6$$

$$X = 5 + 1 = 6$$

Since  $X = T$ , the condition for the GOTO operation is not satisfied, so the GOTO is not executed, leaving  $X = 6$ .

Therefore, the answer is (A).

## Structured Programming

DO/WHILE Loops

```
DO WHILE <condition> ENDWHILE
```

Example (FEIM):

A computer structured programming program contains the following program segment. What is the value of X after the segment is executed?

```
X = 4
```

```
T = 8
```

```
DO WHILE T ≥ X
```

```
  T = T - 2
```

```
  X = X + 2
```

```
ENDWHILE
```

- (A) 4
- (B) 6
- (C) 8
- (D) 10

## Structured Programming

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In the beginning, the condition  $T \geq X$  is satisfied, so the operations in the loop are executed:

$$T = T - 2 = 8 - 2 = 6$$

$$X = X + 2 = 4 + 2 = 6$$

Going back up to the beginning of the DO WHILE loop, the condition is still satisfied because  $X = T$ ; so the operations in the loop are executed.

$$T = T - 2 = 6 - 2 = 4$$

$$X = X + 2 = 6 + 2 = 8$$

Returning again to the beginning of the DO WHILE loop, the condition is no longer satisfied since now  $X > T$ , so the segment is complete. The final value of  $X = 8$ .

Therefore, the answer is (C).

## Structured Programming

DO/UNTIL Loops

```
DO UNTIL <condition> ENDUNTIL
```

FOR Loops

```
FOR <counter range> NEXT <counter>
```

Example (FEIM): FOR Loops

A computer structured programming program contains the following program segment. What is the value of X after the segment is executed?

```
X = 0
```

```
FOR T = -1 TO 2
```

```
    X = X + T
```

```
NEXT T
```

- (A) 2
- (B) 3
- (C) 4
- (D) 6

## Structured Programming

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The FOR statement indicates that the loop is repeated four times, when  $T = -1$ ,  $T = 0$ ,  $T = 1$ , and  $T = 2$ . So, in order, the operations are:

$$X = X + T = 0 - 1 = -1$$

$$X = X + T = -1 + 0 = -1$$

$$X = X + T = -1 + 1 = 0$$

$$X = X + T = 0 + 2 = 2$$

Therefore, the answer is (A).

## Structured Programming

Example (FEIM): Data Arrays

The numbers  $-3, 5, 2, -6, -1, 3, \dots$  are in a file to be read and processed by the structured programming that follows.

```
I = 1
```

```
Y = 0
```

```
WHILE I ≤ 3
```

```
  Read a value from the file and set X equal to that value.
```

```
  If  $X < 0$  GOTO 1
```

```
  ELSE  $Y = Y + X * X$ 
```

```
  1 I = I + 1
```

```
ENDWHILE
```

```
  Z = Y / I
```

The number after the structured programming is executed is most nearly

(A) 7.3

(B) 9.7

(C) 19.5

(D) 26.0

## Structured Programming

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First, the WHILE loop will repeat for  $I = 1, 2,$  and  $3$ .

When  $I = 1, X = -3,$  and the  $Y = Y + X * X$  instruction is not executed.

When  $I = 2, X = 5,$  and  $Y = Y + X * X = 0 + 5 * 5 = 25$ .

When  $I = 3, X = 2,$  and  $Y = Y + X * X = 25 + 2 * 2 = 29$ .

$I$  is incremented to  $I = 4$ .

The WHILE loop is exited, and the last instruction is executed:

$$Z = Y / I = 29 / 4 \approx 7.3$$

Therefore, the answer is (A).