INDUSTRIAL

Discipline-Specific Review for the FE/EIT Exam

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COMPUTER COMPUTATIONS AND MODELING

1. The hexadecimal number 7E16 is equivalent to which binary number?

(A) 0111 1011 0001 0101
(B) 1000 0100 1110 1010
(C) 0111 1110 0001 0110
(D) 1000 1110 0101 0101

Solution:

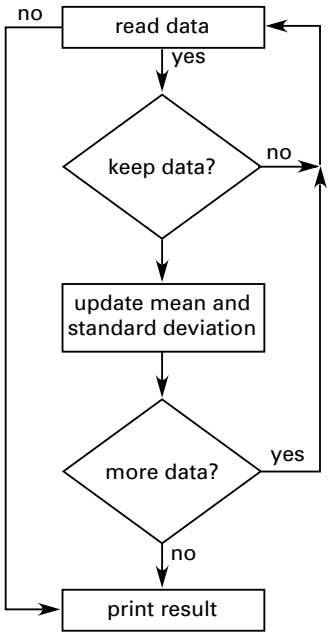
The conversion is made by realizing that each set of 4 binary digits (bits) represents one hexadecimal digit.

$$7_{16} = 0111_2$$
$$E_{16} = 1110_2$$
$$1_{16} = 0001_2$$
$$6_{16} = 0110_2$$
$$7E16_{16} = 0111\ 1110\ 0001\ 0110$$

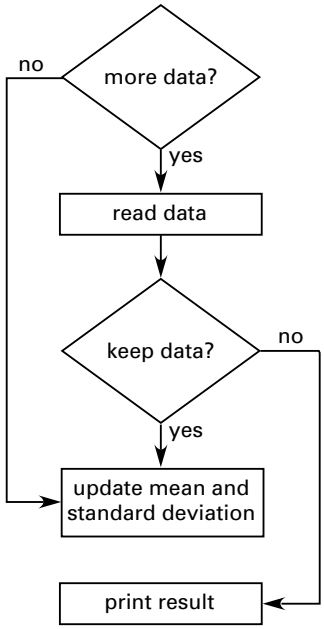
Answer is C.

2. An industrial engineer has been asked to write a computer code that will determine the mean and standard deviation for the process time of a given part. The data input file to be read contains information on all parts produced in the plant. Data that is corrupted is not retained for calculation. Which of the following flow charts represents the correct logic for the computer code?

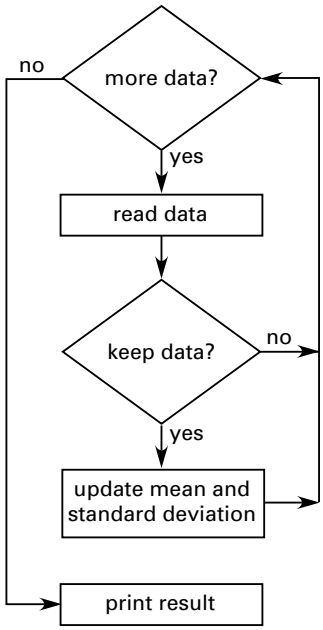
(A)



(B)



(C)



1. A spreadsheet has been developed to calculate the cycle time for an assembly line required to meet a given production demand. Cells A1 through A5 contain the task times, cell B1 contains the number of stations, and cell B2 contains the cycle time. If cell C1 is to contain the balance delay for the solution, what formula should be put into it?

(A) (SUM(A1...A5) + B1*B2)/(B1 + B2)
(B) (B1 − (SUM(A1...A5)/B1*B2))/(SUM(B1...B2))
(C) (B1*B2 − SUM(A1...A5))/SUM(A1...A5)
(D) (B1*B2 − SUM(A1...A5))/B1*B2

2. Ignoring headers, blocks, and line errors, calculate the approximate time to transmit a data file containing 70,000 characters over a 9600 bit/sec transmission line.

(A) 0.01 min
(B) 0.1 min
(C) 1 min
(D) 10 min

3. A data file contains the last 12 months of sales data from the Ohio Valley region. The manager is trying to determine the number of sales personnel to assign to the region for the next month. She has written a pseudocode segment to forecast the expected sales for next month and to assign the number of personnel. The data are

$$400, 500, 600, 400, 800, 850, 950,$$
$$1100, 1150, 1300, 1320, 1440$$

The pseudocode segment is as follows.

```
N = 1
Read data point
While N < 8
Increment N by 1
Read data point
Endwhile
Initialize F to 0 and set N = 1
While N < 6
Increment N by 1
Read data point and add value to F
Endwhile
Set P = F/(N − 1)
If P < 1000 set SF = 5
If P > 999 and P < 1300 set SF = 8
If P > 1299 and P < 1450 set SF = 10
Else set SF = 14
```

The number of sales personnel, SF, at the end of this segment would be

(A) 5
(B) 8
(C) 10
(D) 14

4. A two-way factorial design is used to determine whether a treatment is significant at a 0.05 level. The analysis of a variance table from experimental results is shown as follows.

source of variation	degrees of freedom	sum of squares
replications	4	122.46
treatments	4	126.92
residuals	16	116.08

Which of the following statements is true?

(A) One can conclude that the treatment is significant at a 0.05 level.
(B) One can conclude that the treatment is not significant at a 0.05 level.
(C) The replication error is significant, thus one cannot make a conclusion.
(D) The replication error is significant, thus one can conclude that the treatment is significant at a 0.05 level.

5. A 2^2 factorial design with three replications is used to determine significant factors at an 0.05 level. The analysis of the variance table from experimental results is shown as follows.

source of variation	degrees of freedom	sum of squares
factor A	1	108.50
factor B	1	61.22
cross term AB	1	9.60
errors	8	32.00

One can conclude that

(A) factor A is significant at an 0.05 level
(B) factor A and B are both significant at an 0.05 level
(C) factor A and B and cross term AB are all significant at an 0.05 level
(D) none of the factors are significant

SOLUTIONS FOR THE PRACTICE EXAM

1. The balance delay is

$$\frac{\text{(no. of stations)(cycle time)} - \text{sum of task times}}{\text{(no. of stations)(cycle time)}}$$

Answer is D.

2. t = transmission time
f = number of bits to be transmitted
r = transmission line rate

$$t = \frac{f}{r}$$

Assuming a character is represented by 8 bits, then

$$f = (70{,}000)(8 \text{ bits})$$

$$t = \frac{(70{,}000)(8 \text{ bits})}{9600 \ \frac{\text{bits}}{\text{sec}}}$$

$$= 58.3 \text{ sec} \quad (1 \text{ min})$$

Answer is C.

3. The first "while" statement in the pseudocode reads the first seven data points from the data file. The second "while" statement reads the next five data points from the data file and adds them together. It also increments N by 1 each time. This yields the value $F = 1100 + 1150 + 1300 + 1320 + 1440 = 6310$ and $N = 6$. The code then sets $P = F/(N-1)$, which gives $P = 6310/5 = 1262$. The value 1262 satisfies the second "if" statement, hence the value for SF is 8.

Answer is B.

4. From the table,

$$F^*_{4,16,0.05} = 3.01$$

The mean squares for errors is

$$\frac{116.08}{16} = 7.255$$

The mean squares for replications is

$$\frac{122.46}{4} = 30.62$$

$$F = \frac{30.62}{7.255} = 4.22$$

The mean squares for treatments is

$$\frac{126.92}{4} = 31.73$$

$$F = \frac{31.73}{7.255} = 4.37$$

Although the treatments are significant at 0.05, the replications are also significant. The results have a lack-of-fit problem, and a conclusion cannot be made.

Answer is C.

5. From the table,

$$F^*_{1,8,0.05} = 5.32$$

The mean squares for errors is

$$\frac{32}{8} = 4.00$$

The mean square for A is

$$\frac{108.5}{1} = 108.50$$

$$F = \frac{108.50}{4.00} = 27.13$$

The mean square for B is

$$\frac{61.22}{1} = 61.22$$

$$F = \frac{61.22}{4.00} = 15.31$$

The mean square for AB is

$$\frac{9.60}{1} = 9.60$$

$$F = \frac{9.60}{4.00} = 2.40$$

F values from factors A and B are greater than F^*. Thus, factors A and B are both significant at a 0.05 level.

Answer is B.

6. Choice (C) is correct. The rationale is that for most engineering properties, the high-order cross terms are usually nonexistent, thus they can be used as error terms if more experiments are not feasible.

Answer is C.