**Information Technology**
Providing the Industrial Perspective on IT
**Master of Science (M.Sc.)**
**www.it-master.org**

Hochschule Ostwestfalen-Lippe
University of Applied Sciences

## Solution of the Entrance Test

# !! STOP !!

# Please try to find your own solution first

**OK, please go ahead ...**

**Solution 1** Yes.

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**Solution 2** The final value of the integer variable "max" after the following statements contains the maximum value in the array:

```
int max = A[0]
for i = 1 to N-1
   if(max<A[i])max = A[i]
```

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**Solution 3** Variance = 1.19

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**Solution 4** $\nabla f = (2x, -2y)^T$

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**Solution 5** Input variable $x$, output variable $y$, time $t$:

- Additivity: $x_1(t) \to y_1(t), \quad x_1(t) + x_2(t) \to y_1(t) + y_2(t)$.
- Multiplication with a constant: $C \cdot x_1(t) \to C \cdot y_1(t)$.
- Time invariance: $x_1(t) \to y_1(t), \quad x_1(t-T) \to y_1(t-T)$.
- Convolution: $y(t) = \int_{-\infty}^{\infty} h(\tau) \cdot x(t-\tau)\, d\tau$ : $h(t)$ is the impulse response of a LTI system.

*At least 3 items are desired for a "correct" answer!*

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**Solution 6**

$$z = \overline{\left(B + \overline{AB} + \overline{C\overline{D}}\right)} = \overline{\left(B + \overline{A} + \overline{B} + \overline{C\overline{D}}\right)} = \cdots$$

$$\cdots = \overline{\left((B + \overline{B}) + \overline{A} + \overline{C\overline{D}}\right)} = \overline{\left(1 + \overline{A} + \overline{C\overline{D}}\right)} = \overline{1} = 0.$$

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**Solution 7** The final value of the integer variable "sum" after the following statements contains the sum of all the values in the array:

```
int sum = 0
for i = 0 to N-1
   sum = sum + A[i]
```

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**Solution 8** Right answer: B

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**Solution 9** Right answer: C

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**Solution 10** Possible answers: $i(t) = 4.24\text{A} \cdot \cos(\omega t + 30°)$ ; $i(t) = 3\text{A} \cdot \cos(\omega t + 30°)$

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**Solution 11**

A FIR-Filter is a special type of a digital filter which reacts with a finite impulse response. An IIR-Filter is a special type of a digital filter with an infinite impulse response.

The *z*-system function can be expressed as $H(z) = \frac{\sum_i b_i \cdot z^{-i}}{\sum_j a_j \cdot z^{-j}} = \frac{D(z)}{N(z)}$

FIR-Filter: $D(z) \neq 0, N(z) = 1$. IIR-Filter: $D(z) \neq 0, N(z) \neq 1$.

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**Solution 12** The impulse response is a sinc function.

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**Solution 13** $x + 1$

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**Solution 14** 500 kHz

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**Solution 15** A multiple of $\vec{u} = (1,-1)^T$ or $\vec{u} = (1,1)^T$

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**Solution 16** Answer: A, C, D

*At least 2 items are desired for a "correct" answer!*

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**Solution 17** Answer: "0"

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**Solution 18** At most 127.3 days or 22.6 hours, respectively.

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**Solution 19** Probability = 0.3061

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**Solution 20** Yes.

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