Übungsaufgaben Zahlensysteme:

1. **Wie groß ist der Informationsgehalt einer 8-stelligen Binärinformation?**
2. **Berechne den Dezimalwert folgender Dualzahlen:**
   1. 1101111010(2) b) 1010110(2) c) 1111111001(2) d) 1100110011(2)
3. **Berechne den Dezimalwert folgender Hexadezimalzahlen:**
   1. 14F5B(16) b) AB3D(16) c) 5EA3(16) d) 9C23(16)
4. **Übertrage folgende Dezimalzahlen in die Dualwerte und Hexadezimalwerte:**
   1. 3.786(10) b) 14.876(10) c) 2.243(10) d) 1.024(10)
5. **Übertrage die Dualzahlen in das Hexadezimalsystemzahlen:**
   1. 1101111010(2) b) 1010110(2) c) 1111111001(2) d) 1100110011(2)
6. **Übertrage die Hexadezimalzahlen in Dualzahlen:**
   1. 14F5B(16) b) AB3D(16) c) 5EA3(16) d) 9C23(16)
7. **Addiere folgende Dualzahlen (schriftlich) und konvertiere das Ergebnis in eine Dezimalzahl:**
   1. 1110(2) + 1001(2) b) 110111(2) + 101110(2) c) 1010110(2) + 1100111(2)
8. **Subtrahiere folgende Dualzahlen (schriftlich) und konvertiere das Ergebnis in eine Dezimalzahl:**
   1. 110111(2) - 11010(2) b) 1100110(2) - 111001(2) c) 10101010(2) - 1111101(2)
9. **Multipliziere folgende Dualzahlen (schriftlich) und konvertiere das Ergebnis in eine Dezimalzahl:**
   1. 111(2) \* 1011(2) b) 1010(2) \* 110011(2) c) 111(2) \* 1101(2)
10. **Dividiere folgende Dualzahlen (schriftlich) und konvertiere das Ergebnis in eine Dezimalzahl:**
    1. 10010001(2) : 101(2) b) 1101100110(2) : 1010(2) c) 1111111001(2) : 1110001(2)

© Uwe Widmann, Managment-Service 24.05.01

Eine Lösungsanleitungen kann im Internet unter als Acrobat-PDF - Datei abgerufen werden![**www.widmann-service.de**](http://www.widmann-service.de/)

**Lösungen zu den Übungsaufgaben Zahlensysteme:**

1. **Maximal können 255(10) Zahlen zzgl. des Wertes 0 = 256 Werte dargestellt werden.**
2. **a) 1 1 0 1 1 1 1 0 1 0 (2) = 890(10)**

0 \* 2(0)

|  |  |
| --- | --- |
| (= 1) | 0 |
| (= 2) | 2 |
| (= 4) | 0 |
| (= 8) | 8 |
| (= 16) | 16 |
| (= 32) | 32 |
| (= 64) | 64 |
| (= 128) | 0 |
| (= 256) | 256 |
| (= 512) | 512 |
|  | **890**(10) |
| (= 1) | 0 |
| (= 2) | 2 |
| (= 4) | 4 |
| (= 8) | 0 |
| (= 16) | 16 |
| (= 32) | 0 |
| (= 64) | 64 |
|  | **86**(10) |
| (= 1) | 1 |
| (= 2) | 0 |
| (= 4) | 0 |
| (= 8) | 8 |
| (= 16) | 16 |
| (= 32) | 32 |
| (= 64) | 64 |
| (= 128) | 128 |
| (= 256) | 256 |
| (= 512) | 512 |

1 \* 2(1)

0 \* 2(2)

1 \* 2(3)

1 \* 2(4)

1 \* 2(5)

1 \* 2(6)

0 \* 2(7)

1 \* 2(8)

1 \* 2(9)

* 1. **1010110(2) = 86(10)**

0 \* 2(0)

1 \* 2(1)

1 \* 2(2)

0 \* 2(3)

1 \* 2(4)

0 \* 2(5)

1 \* 2(6)

* 1. **1111111001(2) = 1.017(10)**

1 \* 2(0)

0 \* 2(1)

0 \* 2(2)

1 \* 2(3)

1 \* 2(4)

1 \* 2(5)

1 \* 2(6)

1 \* 2(7)

1 \* 2(8)

1 \* 2(9)

* 1. **1100110011(2) = 819(10)**

1 \* 2(0)

1 \* 2(1)

0 \* 2(2)

0 \* 2(3)

1 \* 2(4)

1 \* 2(5)

0 \* 2(6)

0 \* 2(7)

1 \* 2(8)

1 \* 2(9)

**1.017**(10)

**819**(10)

|  |  |
| --- | --- |
| (= 1) | 1 |
| (= 2) | 2 |
| (= 4) | 0 |
| (= 8) | 0 |
| (= 16) | 16 |
| (= 32) | 32 |
| (= 64) | 0 |
| (= 128) | 0 |
| (= 256) | 256 |
| (= 512) | 512 |

1. **a) 14F5B(16) = 85.851(10)**

B \* 16(0)

5 \* 16(1)

F \* 16(2)

4 \* 16(3)

1 \* 16(4)

# AB3D(16) = 43.837(10)

D \* 16(0)

3 \* 16(1)

B \* 16(2)

A \* 16(3)

# 5EA3(16) = 24.227(10)

3 \* 16(0)

A \* 16(1)

E \* 16(2)

5 \* 16(3)

# 9C23(16) = 39.971(10)

3 \* 16(0)

2 \* 16(1)

C \* 16(2)

9 \* 16(3)

**85.851**(10)

|  |  |
| --- | --- |
| (= 1) | 11 |
| (= 16) | 80 |
| (= 256) | 3.840 |
| (= 4.096) | 16.384 |
| (= 65.536) | 65.536 |

**43.837**(10)

|  |  |
| --- | --- |
| (= 1) | 13 |
| (= 16) | 48 |
| (= 256) | 2.816 |
| (= 4.096) | 40.960 |

|  |  |
| --- | --- |
| (= 1) | 3 |
| (= 16) | 160 |
| (= 256) | 3.584 |
| (= 4.096) | 20.480 |

**24.227**(10)

1. **a) 3786(10) = 11 10 11 00 10 10(2) = ECA(16)**

|  |  |
| --- | --- |
| (= 1) | 3 |
| (= 16) | 32 |
| (= 256) | 3.072 |
| (= 4.096) | 36.864 |
|  | **39.971**(10) |

# 14.876(10) = 11 00 10 00 01 11 00(2) = 3A 1C(16)

|  |  |  |  |
| --- | --- | --- | --- |
| 14.876 | : 2 | 7438 R 0 |  |
| 7.438 | : 2 | 3719 R 0 |  |
| 3.719 | : 2 | 1859 R 1 |  |
| 1.859 | : 2 | 929 R 1 |  |
| 929 | : 2 | 464 R 1 |  |
| 464 | : 2 | 232 R 0 |  |
| 232 | : 2 | 116 R 0 |  |
| 116 | : 2 | 58 R 0 |  |
| 58 | : 2 | 29 R 0 |  |
| 29 | : 2 | 14 R 1 |  |
| 14 | : 2 | 7 R 0 |  |
| 7 | : 2 | 3 R 0 |  |
| 3 | : 2 | 1 R 1 |  |
| 1 | : 2 | 0 R 1 | **11 00 10 00 01 11 00(2)** |
| 14.876 | : 16 | 929 R C |  |
| 929 | : 16 | 58 R 1 |  |
| 58 | : 16 | 3 R A |  |
| 3 | : 16 | 0 R 3 | **3A 1C(16)** |
| **00 11 00 00 11(2) = 8C3(16)** | | | |

* 1. **2.243(10) = 10**
  2. **1.024(10) = 1 00 00 00 00 00(2) = 400(16)**

1. **a) 1101111010(2) = 37A(16)**

11 0111 1010

3 7 A

1. **1010110(2) = 56(16)**

101 0110

5 6

# 1111111001(2) = 3F9(16)

11 1111 1001

3 F 9

1. **1100110011(2) = 333(16)**

11 0011 0011

3 3 3

1. **a) 14F5B(16) = 10 100 1111 0101 1011(2)**

1 4 F 5 B

1 0100 1111 0101 1011

# AB3D(16) = 1010 1011 0011 1101(2)

A B 3 D 1010 1011 0011 1101

# 5EA3(16) = 101 1110 1010 0011(2)

5 E A 3

101 1110 1010 0011

# 9C23(16) = 1001 1010 0010 0011(2)

9 C 2 3

1001 1010 0010 0011

1. **a) 1110(2) + 1001(2) = 1 0111(2)**

1 1 1 0

(1) 1 0 0 1

1 0 1 1 1

14(10) + 9(10) = 23(10)

* 1. **110111(2) + 101110(2) = 110 0101(2)**

1 1 0 1 1 1

(1) (1)1 (1)0 (1)1 (1)1 1 0

1 1 0 0 1 0 1

55(10) + 46(10) = 101(10)

* 1. **1010110(2) + 1100111(2) = 1011 1101(2)**

1 0 1 0 1 1 0

(1) 1 1 0 (1)0 (1)1 1 1

1 0 1 1 1 1 0 1

86(10) + 103(10) = 189(10)

1. **a) 110111(2) - 11010(2) = 1 1101(2)**

55(10) - 26(10) = 29(10)

* 1. **1100110(2) - 111001(2) = 10 1101(2)**

102(10) - 57(10) = 45(10)

* 1. **10101010(2) - 1111101(2) = 10 1101(2)**

170(10) - 125(10) = 45(10)

1. **a) 111(2) \* 1011(2) = 100 1101(2)**

7(10) \* 11(10) = 77(10)

* 1. **1010(2) \* 110011(2) = 1 1111 1110(2)**

1 0 1 0 \* 1 1 0 0 1 1

1 0 1 0

1 0 1 0

0 0 0 0

0 0 0 0

1 0 1 0

1 0 1 0

1 1 1 1 1 1 1 1 0

10(10) \* 51(10) = 510(10)

* 1. **111(2) \* 1101(2) = 101 1011(2)**

7(10) \* 13(10) = 91(10)

1. **Beispiel aus den Unterlagen ( 100000101(2) : 11(2) = 101 0111(2)):**

1 1 **= 1**

1 0 0 **= 0**

1 1 **= 1**

1 0 1 **= 0**

1 1 **= 1**

1 0 0

1 1 **= 1**

1 1

1 1 **= 1**

0

261(10) : 3(10) = 87(10)

1. **10010001(2) : 101(2) = 1 1101(2)**

1 0 1 **= 1**

1 0 0 0

1 0 1 **= 1**

1 1 0

1 0 1 **= 1**

1 0 1 **= 0**

1 0 1 **= 1**

0

145(10) : 5(10) = 29(10)

1. **1101100110(2) : 1010(2) = 101 0111(2)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 **:** | 1 | 0 | 1 | 0 | **= 101 0111** |

1 0 1 0 **= 1**

1 1 1 1

1 0 1 0 **= 1**

1 0 1 0

1 0 1 0 **= 1**

0

870(10) : 10(10) = 87(10)

1. **1111111001(2) : 1110001(2) = 1001(2)**

1 1 1 1 1 1 1 0 0 1 **:** 1 1 1 0 0 0 1 **= 1 0 0 1**

1 1 1 0 0 0 1 **= 1**

1 1 1 0 0 0 1 **= 0 0**

1 1 1 0 0 0 1 **= 1**

0

1017(10) : 113(10) = 9(10)

|  |  |  |  |
| --- | --- | --- | --- |
| 3.786 | : 2 | 1.893 R 0 |  |
| 1.893 | : 2 | 946 R 1 |
| 946 | : 2 | 473 R 0 |
| 473 | : 2 | 236 R 1 |
| 236 | : 2 | 118 R 0 |
| 118 | : 2 | 59 R 0 |
| 59 | : 2 | 29 R 1 |
| 29 | : 2 | 14 R 1 |
| 14 | : 2 | 7 R 0 |
| 7 | : 2 | 3 R 1 |
| 3 | : 2 | 1 R 1 |
| 1 | : 2 | 0 R 1 | **11 10 11 00 10 10(2)** |
| 3786 | : 16 | 236 R A |  |
| 236 | : 16 | 14 R C |  |
| 14 | : 16 | 0 R E | **ECA(16)** |

|  |  |  |  |
| --- | --- | --- | --- |
| 2.243 | : 2 | 1121 R 1 |  |
| 1121 | : 2 | 560 R 1 |
| 560 | : 2 | 280 R 0 |
| 280 | : 2 | 140 R 0 |
| 140 | : 2 | 70 R 0 |
| 70 | : 2 | 35 R 0 |
| 35 | : 2 | 17 R 1 |
| 17 | : 2 | 8 R 1 |
| 8 | : 2 | 4 R 0 |
| 4 | : 2 | 2 R 0 |
| 2 | : 2 | 1 R 0 |
| 1 | : 2 | 0 R 1 | **10 00 11 00 00 11(2)** |
| 2.243 | : 16 | 140 R 3 |  |
| 140 | : 16 | 8 R C |  |
| 8 | : 16 | 0 R 8 | **8C3(16)** |

|  |  |  |  |
| --- | --- | --- | --- |
| 1.024 | : 2 | 512 R 0 |  |
| 512 | : 2 | 256 R 0 |
| 256 | : 2 | 128 R 0 |
| 128 | : 2 | 64 R 0 |
| 64 | : 2 | 32 R 0 |
| 32 | : 2 | 16 R 0 |
| 16 | : 2 | 8 R 0 |
| 8 | : 2 | 4 R 0 |
| 4 | : 2 | 2 R 0 |
| 2 | : 2 | 1 R 0 |
| 1 | : 2 | 0 R 1 | **1 00 00 00 00 00** |
| 1.024 | : 16 | 64 R 0 |  |
| 64 | : 16 | 4 R 0 |  |
| 4 | : 16 | 0 R 4 | **400** |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 1 | 0 | 1 | 1 | 1 |  |
| 1 | 0 | 0 | (1)1 | 1 | 0 | **Zwei-Komplement** |
| **~~1~~** | ~~0~~ | 1 | 1 | 1 | 0 | 1 |  |
| **Zwischenrechnung Zwei-Komplement:** | | | | | | | |
| 0 | | 1 | 1 | 0 | 1 | 0 | **Auffüllen mit 0** |
| 1 | | 0 | 0 | 1 | 0 | 1 | **Eins-Komplement (Umkehrung)** |
| 1 | | 0 | 0 | 1 | 1 | 0 | **Zwei-Komplement (Eins-K. + 1)** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 1 | 0 | 0 | 1 | 1 | 0 |  |
| (1) | 1 | 0 | 0 | (1)0 | (1)1 | 1 | 1 | **Zwei-Komplement** |
| ~~1~~ | ~~0~~ | 1 | 0 | 1 | 1 | 0 | 1 |  |
| **Zwischenrechnung Zwei-Komplement:** | | | | | | | | |
| 0 | | 1 | 1 | 1 | 0 | 0 | 1 | **Auffüllen mit 0** |
| 1 | | 0 | 0 | 0 | 1 | 1 | 0 | **Eins-Komplement** |
| 1 | | 0 | 0 | 0 | 1 | 1 | 1 | **Zwei-Komplement** |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |  |
| (1) | 1 | 0 | 0 | 0 | 0 | (1)0 | 1 | 1 | **Zwei-Komplement** |
| ~~1~~ | ~~0~~ | ~~0~~ | 1 | 0 | 1 | 1 | 0 | 1 |  |
| **Zwischenrechnung Zwei-Komplement:** | | | | | | | | | |
| 0 | | 1 | 1 | 1 | 1 | 1 | 0 | 1 | **Auffüllen mit 0** |
| 1 | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **Eins-Komplement** |
| 1 | | 0 | 0 | 0 | 0 | 0 | 1 | 1 | **Zwei-Komplement** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | \* | 1 | 0 | 1 | 1 |  |
|  | 1 | 1 | 1 |  |  |  |  | **Addition mit Stellenverschiebung** |
|  |  | 0 | 0 | 0 |  |  |  |  |
|  |  |  | 1 | 1 | 1 |  |  |  |
|  | (1) | (1) | (1) | (1)1 | 1 | 1 |  |  |
| 1 | 0 | 0 | 1 | 1 | 0 | 1 |  |  |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | \* | 1 | 1 | 0 | 1 |
|  | 1 | 1 | 1 |  |  |  |  |
|  |  | 1 | 1 | 1 |  |  |  |
|  |  |  | 0 | 0 | 0 |  |  |
|  | (1) | (1) | (1) | 1 | 1 | 1 |  |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 |  |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 **:** | 1 | 1 | **= 101 0111** |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 **:** | 1 | 0 | 1 | **= 1 1101** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 0 1 0 |  |  | **= 1** | | |
| 1 1 | 1 | 0 | **= 0** | | |
| 1 0 1 0 | | |  |  | **= 1** |
| 1 0 0 | | | 0 | 1 | **= 0** |