Übungsaufgaben Zahlensysteme:

1. **Wie groß ist der Informationsgehalt einer 8-stelligen Binärinformation?**

**255 + 0 = 256 || 0/1 0/1 0/1 0/1 0/1 0/1 0/1 0/1 || 8Basis2 = 8 bits (1Byte) || 2^8 = 256**

1. **Berechne den Dezimalwert folgender Dualzahlen:**
   1. 1101111010(2) b) 1010110(2) c) 1111111001(2) d) 1100110011(2)

a) 890basis10 b) 86basis10 c) 1.017basis10 d)819basis10

1. **Berechne den Dezimalwert folgender Hexadezimalzahlen:**
   1. 14F5B(16) b) AB3D(16) c) 5EA3(16) d) 9C23(16)

16^4 = 65.536 (4)| 16^3 = 4.096 (3)| 16^2 = 256 (2)| 16^1 = 16 (1)| 16^0 = 1 (0)

a) 1\*(16^4)+4\*(16^3)+15\*(16^2)+5\*(16^1)+11\*(16^0) = 85.851

b) 10\*(16^3)+11\*(16^2)+3\*(16^1)+13\*(16^0) = 43.837

c) 24.227

d) 39.971

1. **Übertrage folgende Dezimalzahlen in die Dualwerte und Hexadezimalwerte:**
   1. 3.786(10) b) 14.876(10) c) 2.243(10) d) 1.024(10)

Dual.:

2^16=65.536(16)|2^15=32.768(15)|2^14=16.384(14)|2^13=8.192(13)| 2^12=4.096(12)|2^11=2.048(11)|2^10=1.024(10)|2^9=512(9)|2^8=256(8)| 2^7=128(7)|2^6=64(6)|2^5=32(5)|2^4=16(4)|2^3=8(3)|2^2=4(2)|2^1=2(1)|2^0=1(0)

Hexa.:

1=1|2=2|3=3|4=4|5=5|6=6|7=7|8=8|9=9|10=A|11=B|12=C|13=D|14=E|15=F

16^4 = 65.536 (4)| 16^3 = 4.096 (3)| 16^2 = 256 (2)| 16^1 = 16 (1)| 16^0 = 1 (0)

Dual.: a) 1110 1100 1010 b) 11 1010 0001 1100 c) 1000 1100 0011 d) 100 0000 0000

Hexa.:a) ECA b) 3A1C c) 8C3 d) 400

1. **Übertrage die Dualzahlen in das Hexadezimalsystemzahlen:**
   1. 1101111010(2) b) 1010110(2) c) 1111111001(2) d) 1100110011(2)

Hexa.:

1=1|2=2|3=3|4=4|5=5|6=6|7=7|8=8|9=9|10=A|11=B|12=C|13=D|14=E|15=F

16^4 = 65.536 (4)| 16^3 = 4.096 (3)| 16^2 = 256 (2)| 16^1 = 16 (1)| 16^0 = 1 (0)

a) 3CE 37A b) 56 c) 22D 3F9 d) 333

1. **Übertrage die Hexadezimalzahlen in Dualzahlen:**
   1. 14F5B(16) b) AB3D(16) c) 5EA3(16) d) 9C23(16)

a) 1 0100 1111 0101 1011 b) 1010 1011 0011 1101

c) 0101 1110 1010 0011 d) 1001 1100 0010 0011

1. **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)
2. **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)
3. **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)
4. **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)

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**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 \* 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. **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)

**43.837**(10)

**24.227**(10)

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

# 14.876(10) = 11 00 10 00 01 11 00(2) = 3A 1C(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 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:** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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