Aufgabe 17

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

a)

1. $C_{Ex-127,8}(93) = C_{2,8}(136)$

$= 10001000$

2. $C_{Ex-127,8}(12) = C_{2,8}(139)$

$= 10001011$

3.

$(0111\ 1111)\ C_{Ex-127,8} = C_{Ex-127,8}(127) = 0$

4. $(1010\ 1001)\ C_{Ex-127,8} = C_{Ex-127,8}(169) = 42$

5. $C_{Ex-127,8}(-111) = C_{2,8}(16) = 00010000$

6. $(0110\ 0110)\ C_{Ex-127,8} = C_{Ex-127,8}(108) = -19$

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

b)

1. $C_{Ex-127,8}(13) \oplus C_{Ex-127,8}\ C_{Ex-127,8}(-13)$

$= C_{2,8}(140) \oplus C_{2,8}(114) - C_{2,8}(127)$

$= 1\,000\,1100 \oplus 0\,111\,001C - C_{2,8}(127)$ $\quad \begin{array}{r} 1000\ 1100 \\ +\ 0111\ 001C \\ \hline 1111\ 1110 \end{array}$

$= 1111\ 111C - 0111\ 1111$

$= (0111\ 1111)\, C_{Ex-127,8} = C_{Ex-127,8}(0)$

2. $C_{Ex-127,8}(72) \ominus C_{Ex-127,8}\ C_{Ex-127,8}(-31)$

$= C_{2,8}(199) \ominus C_{Ex-127,8}\ C_{2,8}(96)$ $\quad \begin{array}{r} 1100\ 0111 \\ -\ 011C\ 0000 \\ \hline 011\,0\ 0111 \end{array}$

$= 1100\ 0111 - 011C\ 0000 + 0111\ 1111$

$= 011C\ 0111 + 0111\ 1111$

$= (1110110)_{C_{EX-127,8}} = C_{EX-127,8}(103)$

3.

$1001\ 0110 \oplus C_{EX-127,8}\ 0101\ 0101$

$= 1001\ 0110 + 0101\ 0101 - 0\ 111\ 1111$

$= 1110\ 1011 - 0\ 111\ 1111$

$= (0110\ 1100)_{C_{EX-127,8}} = C_{EX-127,8}(-19)$

4. $10010110 \ominus_{C_{Ex-127,8}} 01010101 =$

$10010110 - 01010101 + 0111\ 1111$

$= 0100\ 0001 + 0111\ 1111$

$= (1100\ 0000)_{C_{Ex-127,8}} = C_{Ex-127,8}(GS)$

Aufgabe 18

a)

1. $c_{FK\ 4,4}(0.25) = c_{2,4}(rd(0.25 \cdot 2^4))$

$= c_{2,4}(4) = 0100$

2. $c_{FK\ 4,4}(0.7) = c_{2,4}(rd(11,2)) = c_{2,4}(11)$

$= 1011$

3. $c_{FK\ 4,4}(0.6) = c_{2,4}(rd(9,6)) = c_{2,4}(10)$

$= 1010$

4. $(c_{FK\ 4,4}(0.6))_{FK\ 4,4} = (1010)_{FK\ 4,4} = c_{FK\ 4,4}(0.625)$

5. $(0111)_{FK\ 4,4} = c_{FK\ 4,4}(0.4375)$

b)

1. $c_{FK\ 4,4}(0.4) \oplus_{FK\ 4,4} c_{FK\ 4,4}(0.1) =$

$c_{2,4}(6) \oplus_{FK\ 4,4} c_{2,4}(2)$

$= 0110 \oplus_{FK\ 4,4} 0010 = (1000)_{FK\ 4,4} = c_{FK\ 4,4}(0.5)$

2.

$$1001 \oplus_{FK\ 4,4} 0011 = (1100)_{FK\ 4,4} = C_{FK\ 4,4}(0.625)$$

3. $1001 \ominus_{FK\ 4,4} 0011 = (0110)_{FK\ 4,4} = C_{FK\ 4,4}(0.375)$

d) 1. $|0,3 - (C_{FK\ 4,4}(0.3))_{FK\ 4,4}| = |0,3 - (C_{2,4}(5))_{FK\ 4,4}|$

$= |0,3 - (0101)_{FK\ 4,4}| = |0,3 - 0,3125| = 0,0125$

2. $|0.2+0.6 - (C_{FK\ 4,4}(0.2) \oplus_{FK\ 4,4} C_{FK}(0.6))_{FK\ 4,4}|$

$= |0.8 - (C_{2,4}(3) \oplus_{FK\ 4,4} C_{2,4}(10))_{FK\ 4,4}|$

$= |0.8 - (0011 \oplus_{FK\ 4,4} 1010)_{FK\ 4,4}|$

$= |0.8 - (1101)_{FK\ 4,4}| = |0.8 - 0,8125| = 0.0125$

3. $C_{FK\ S2\ S2}^{(m-1)}$

4. $2^{-4} = 0.0625$

5. mindestens 6 Bit

- bei $k = 4$ und $k = 5$ liegt der absolute RF bei 0.0125
- bei $k = 6$ liegt er bei unter 0.01

6.

$$|0.8 - (C_{FK\,4,4}(0.8))_{FK\,4,4}| = |0.8 - (C_{2,4}(13))_{FK\,4,4}|$$

$$= |0.8 - (1101)_{FK\,44}| = |0.8 - 0.8125| = 0.0125$$

Aufgabe 19

Samstag, 26. November 2022 22:49

a)

1) $17.5 = 8{,}75 \cdot 2^1 = 4{,}375 \cdot 2^2 = 2{,}1875 \cdot 2^3 = 1{,}09375 \cdot 2^4$

2) $0.021 = 0{,}042 \cdot 2^{-1} = 0{,}084 \cdot 2^{-2} = 0{,}168 \cdot 2^{-3} = 0{,}336 \cdot 2^{-4} = 0{,}672 \cdot 2^{-5} = 1{,}344 \cdot 2^{-6}$

b)

1) $c_{GK,11,16}(0.3)$

$0{,}3 = 0{,}6 \cdot 2^{-1} = 1{,}2 \cdot 2^{-2}$

Vorzeichen : 0 $\Rightarrow$ Positiv

$q = 2^{16-11-1} - 1 = 2^4 = 15$

$c_{EX-15,5}(-2) = c_{2,5}(-2+15) = c_{2,5}(13) = 01101$

$c_{FIK_{10,10}}(0{,}2) = c_{2,10}(\mathrm{rd}(0{,}2 \cdot 2^9)) = c_{2,10}(205) = 0011001101$

0	01101	0011001101
Vz.	Ch.	M.

2) $(0\ 01101\ 0011001101)_{GK,11,16}$

$q = 2^{16-11-1} - 1 = 2^4 = 15$

$(01101)_{EX-15,5} = c_{4,5}(13-15) = c_{2,5}(-2)$

$m = (0011001101)_{FIK,10,10} + 1 = c_{2,10}(205) + 1 = c_{FIK\,10,10}\left(\frac{205}{2^{10}}\right) + 1 = 0{,}2 + 1 = \underline{1{,}2}$

$\Rightarrow 1{,}2 \cdot 2^{-2} = 0{,}3$

3)

$c_{GK-10,16}(0{,}3)$

$0{,}3 = 1{,}2 \cdot 2^{-2}$

$n-k = 16-10 = 6$

$q = 2^{6-1} - 1 = 2^5 - 1 = 31$

$C_{Ex-31,6}(-2) = C_{2,6}(-2+31) =$

$= C_{2,6}(29) = (011101)_2$

$C_{FK-9,9}(1,2-1) = C_{FK-9,9}(0,2) := C_{2,9}(0,2 \cdot 2^9) = C_{2,9}(102) = (001100110)_{2,9}$

$\Rightarrow 0,2 \cdot 29 = rd(102,4) \Rightarrow 102$

$\downarrow$

$0,4$

4) $C_{gK,11,16}(-24)$

$-24 = -12 \cdot 2^1 = -6 \cdot 2^2 = -3 \cdot 2^3 = -1,5 \cdot 2^4$

Vorzeichen: 1 => negativ

$q = 2^{16-11-1} - 1 = 15$

$C_{Ex-15,5}(4) = C_{2,5}(4+15) = C_{2,5}(19) = 10011$

$C_{FK,10,10}(0,5) = C_{2,10}(rd(0,5 \cdot 2^{10}) = C_{2,10}(rd(512)) = 1000000000$

1	10011	1000000000

5) $(1\ 10100\ 0010010000)_{gK,11,16}$

$\downarrow$

Negativ

$q = 2^{16-11-1} - 1 = 15$

$(10100)_{Ex-15,5} = C_{2,5}(20-15) = 5$

$(0010010000)_{FK,10,10} + 1 = \left(\frac{144}{2^{10}}\right) + 1 = 1,140625$

$\Rightarrow -1,140625 \cdot 2^5 = -36,5$

6) $0\ \underbrace{0000}\ \underbrace{0000001}$ $\Rightarrow (0\ 0000\ 0000001)_{gK,11,16}$

6) $\underbrace{0}_{\text{Positiv}}\ \underbrace{0000}_{\text{minimale.}}\ \underbrace{0000001}_{\text{minimal.m}} \Rightarrow (0\ 0000\ 0000001)_{gk,11,16}$

$q = 2^{12-8-1} - 1 = 2^3 - 1 = 8 - 1 = 7$

$(0000)_{EX-7,4} = c_{2,4}(0-7) = -7$

$(00000001)_{FK-4,4} + 1 = \frac{1}{2^7} + 1 = 1,0078125$

$1,0078125 \cdot 2^{-7} = 0,007873535156 2$

7) $(0\ 11111\ 1111111110)_{gk\,11,16}$

$q = 2^{16-11-1} - 1 = 15$

$(11111)_{EX-15,5} = c_{2,15}(31-15) = 16$

$(1111111111)_{FK,10,10} + 1 = \frac{1022}{2^{10}} + 1 = 1,99804687$

$1,99804687 \cdot 2^{16} = 130.944$

```c
#include <stdio.h>
#include <math.h>

double fk_decodieren(int festkomma[], int n, int k);
int main(void)
{
	int n, k;
	int festkomma[4] = {0, 1, 1, 1};
	n = 4;
	k = 4;

	printf("Der decodierte Wert ist: %lf\n", fk_decodieren(festkomma, n, k));

	return 0;
}

double fk_decodieren(int festkomma[], int n, int k)
{
	double result;
	int i;
	result = 0;

	for(i = 0; i < n; i++){
		result *= 2;
		result += festkomma[i];
	}

	return result / pow(2, k);

}
```