IDMA 2026
Problem set 1

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Contents

1 Different representations of integers

1.a Write the binary number $(110)_2$ in decimal notation

Binary notation refers to the number system of base 2, where as the decimal notation refers to base 10. I will start by expanding $(110)_2 = 1 * 2^2 + 1 * 2^1 + 0 * 2^0 = 6$, now I will try to write the number 6 in decimal notation. To do that I will use the equation

$$m = q_0 \cdot b + r_0 ...$$

$$...m = q_n \cdot b + r_n$$

where : m : is the number we are trying to rewrite, b : the base, we continue running the recursion process until $q_n = 0$

$$6 = 0 \cdot 10 + 6$$

since $q_0 = 0$ we stop and now we have

$$(110)_2 = (6)_{10}$$

1.b Write the decimal number 110 in binary notation

Following the steps of the previous question, we have

$$(110)_{10} = 1 \cdot 10^2 + 1 \cdot 10^1 + 0 \cdot 10^0 = 110$$

to convert the number 110 to base 2 we use the equation :

$$110 = 55 \cdot 2 + 0$$

$$55 = 27 \cdot 2 + 1$$

$$27 = 13 \cdot 2 + 1$$

$$13 = 6 \cdot 2 + 1$$

$$6 = 3 * 2 + 0$$

$$3 = 1 \cdot 2 + 1$$

$$1 = 0 \cdot 2 + 1$$

Then we have that

$$(110)_{10} = (1101110)_2$$

1.c Write the octal number $(110)_8$ in decimal notation

$$(110)_8 = 1 \cdot 8^2 + 1 \cdot 8^1 + 0 \cdot 8^0 = 64 + 8 + 0 = 72$$

$$72 = 7 \cdot 10 + 2$$

$$7 = 0 \cdot 10 + 7$$

hence

$$(110)_8 = (72)_{10}$$

2 Find the greates common divisor using the algorithm we learned, show the steps then express d as linear combination of m and n

2.a m=38, n=14

2.b m=117, n=69

3 Consider the following algorithm

```
j := 1
while (j<=n) {
        A[j] := 0
        for i := j downto 1 {
                A[j] := A[j]+i*i
        }
        j := j+1
}
```

3.a

3.b

3.c

4

4.a

4.b

4.c