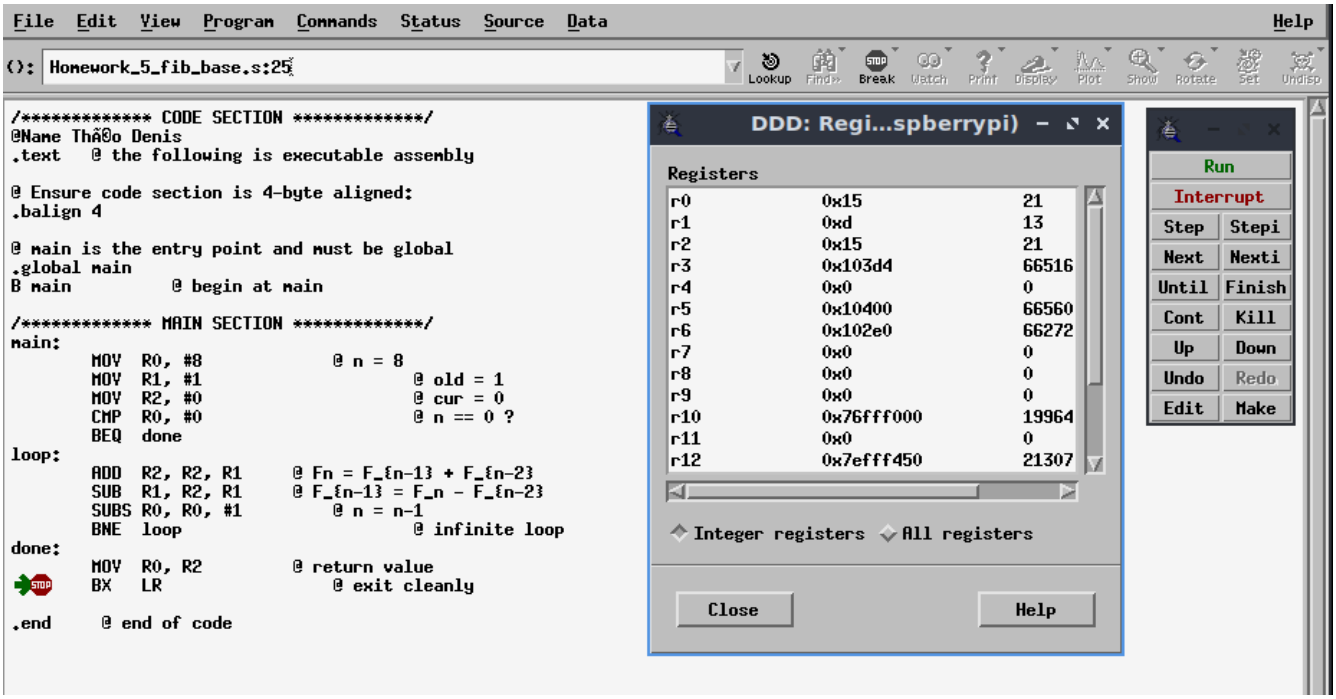
1 Fibonacci code

```
    /************* CODE SECTION *************/
@Name Théo Denis
.text   @ the following is executable assembly

@ Ensure code section is 4-byte aligned:
.balign 4

@ main is the entry point and must be global
.global main
B main          @ begin at main

/************* MAIN SECTION *************/
main:
    MOV  R0, #8         @ n = 8
    MOV  R1, #1         @ old = 1
    MOV  R2, #0         @ cur = 0
    CMP  R0, #0         @ n == 0 ?
    BEQ  done
loop:
    ADD  R2, R2, R1     @ Fn = F_{n-1} + F_{n-2}
    SUB  R1, R2, R1     @ F_{n-1} = F_n - F_{n-2}
    SUBS R0, R0, #1     @ n = n-1
    BNE  loop           @ infinite loop
done:
    MOV  R0, R2         @ return value
    BX   LR             @ exit cleanly

.end                    @ end of code
```

The value for fib(8) obtained with the code was 21 or 0x15 in hexadecimal.

2 DDD screenshot fib



3 Floating point hand analysis

Representation in IEEE754 single point precision

Decimal	Binary	Hexadecimal
2.0	0 10000000 00000000000000000000000	0x40000000
3.5	0 10000000 11000000000000000000000	0x40600000
0.50390625	0 01111110 00000010000000000000000	0x3F010000
65535.6875	0 10001110 11111111111111110110000	0x477FFFB0
0.50390625 + 65535.6875	0 10001111 00000000000000000011000	0x47800018

The last number was truncated at 65536.19.

4 Floating point addition code

```
    /************* CODE SECTION *************/
@Name Théo Denis
@Floating Point Addition
.text   @ the following is executable assembly

@ Ensure code section is 4-byte aligned:
.balign 4

@ main is the entry point and must be global
.global main
b main          @ begin at main

/************* FPNUMS ******************/
@ These addresses contain the two fp numbers to be added

fpNum0:  .word   0x3f010000
fpNum1:  .word   0x477fffb0


/************* MAIN SECTION *************/
main:
    ldr r0, fpNum0     @ r0 = fpNum0
    ldr r1, fpNum1     @ r1 = fpNum1

@ Your Code goes here:
@ masking and shifting down exponents
    LSR r2, r0, #23          @ r2[7:0] = exponent of r0
    LSR r3, r1, #23          @ r3[7:0] = exponent of r1

@ masking and appending leading 1
/* can be perform with orr-ing with leading 1 and then shifting
   left to delete exponent and sign bits */
    ORR r4, r0, #0x00800000
    ORR r5, r1, #0x00800000
    LSL r4, r4, #8           @ r4[31:8] = mantissa of r0
    LSL r5, r5, #8           @ r5[31:8] = mantissa of r1

@ comparing exponents and setting based on value
    SUBS r6, r2, r3          @ r6 = r2 - r3 if r2 > r3
    MOVGE r7, r2             @ r7 = r2 if r2 >= r3
    MOVLT r7, r3             @ r7 = r3 if r2 < r3
```

```
@ right shifting mantissa by difference of exponents
    LSRGT r5, r5, r6          @ r5 = r5 >> r6
    SUBLT r6, r3, r2          @ r6 = r3 - r2 if r3 > r2
    LSRLT r4, r4, r6          @ r4 = r4 >> r6

@ summing mantissas
    ADDS  r8, r4, r5          @ r8 = r4 + r5

@ normalize the result in case of overflowing
    LSRCS r8, r8, #1          @ r8 = r8 >> 1
    ADDCS  r7, r7, #1         @ r7 += 1

@ rounding result, do nothing because trunc is fine

@ strip leading 1 and merge everything
@ R8 = mantissa, R7 = exponent, sign = 0 because work with positive
    LSL r8, r8, #1            @ r8 = r8 << 1 strip leading 1
    LSR r8, r8, #9            @ r8[22:0] = mantissa
    LSL r7, r7, #23           @ r7[31:23] = biased exponent
    ORR r0, r7, r8            @ r0 = sum in IEEE754

    bx lr
.end     @ end of code
```

5 Results of addition

Decimal	Binary	Hexadecimal
2.0	0 10000000 00000000000000000000000	0x40000000
3.5	0 10000000 11000000000000000000000	0x40600000
0.50390625	0 01111110 00000010000000000000000	0x3F010000
65535.6875	0 10001110 11111111111111110110000	0x477FFFB0
0.50390625 + 65535.6875	0 10001111 00000000000000000011000	0x47800018

6 DDD screenshot fp