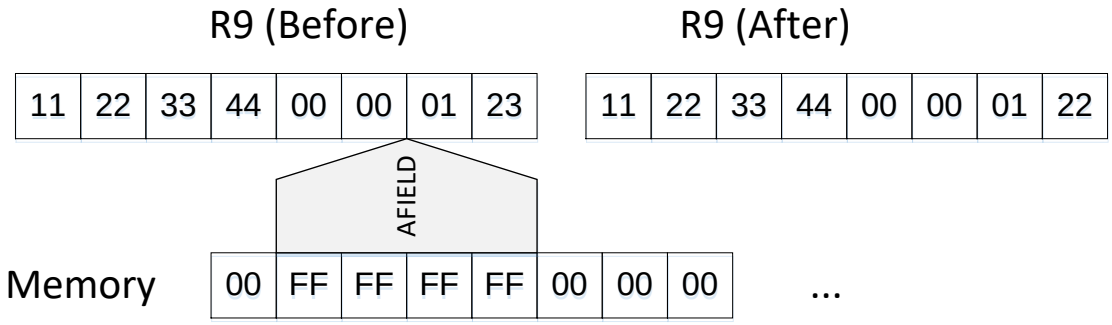
E3	R_1X_2	B_2DL_2	DL_2DL_2	DH_2DH_2	5A

The Add instruction performs 2's complement binary addition. Operand 1 is a register containing a fullword integer. Operand 2 specifies a fullword in memory. The fullword in memory is added to the fullword in the register and the result is stored in the register. The fullword in memory is not changed. The leftmost bits (bits 0 – 31) of the target register are unchanged by this operation. Bits 32-63 contain the resulting sum.

Since **AY** has an RXY-a instruction format, the second operand base/displacement address has a displacement size of 20 bits. This supports a displacement range from -524,288 to 524,287. This is significantly larger than the 12-bit displacement of an add fullword instruction (A) which has a range from 0 – 4095.

Consider the following example,

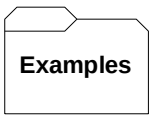
```
A      R9,AFIELD
```



The contents of the fullword "AFIELD", x'FFFFFFFF' = -1 in decimal, are added to register 9 which contains x'00000123' = 291 in decimal. The sum is decimal 290 = x'00000122' = 290 in decimal and destroys the previous value in R9. The fullword in memory is unchanged by this operation.

Since **AY** is an RXY-a instruction, an index register may be coded as part of operand 2.

AY has a two-byte opcode, E35A. The displacement bytes are not stored in sequence in the object code.



Some Unrelated AYs

```
R4 =  X'00000000FFFFFFFE'   -2 IN 2'S COMPLEMENT (bits 32-63)
R5 =  X'0000000000000028'  +40 IN 2'S COMPLEMENT (bits 32-63)
R6 =  X'0000000000000004'   +4 IN 2'S COMPLEMENT (bits 32-63)

        DOG   DC   F'4'
        CAT   DC   F'-4'

AY    R4,=F'20'     R4 = X'0000000000000012' = +18
AY    R5,=F'20'     R5 = X'000000000000003C' = +60
AY    R6,=F'20'     R6 = X'0000000000000018' = +24
AY    R6,=F'-5'     R6 = X'00000000FFFFFFFF' = -1
AY    R6,CAT        R6 = X'0000000000000000' =  0
AY    R6,DOG        R6 = X'0000000000000008' = +8
AY    R6,DOG(R6)    R6 = X'0000000000000000'  INDEXING IS ALLOWED
```

Tips

1. **AY** can reach further with a 20-bit displacement off the base address of a base register than A which has a 12-bit displacement. You might consider using **AY** instead of A in some cases. Rather than adding another base register to fix an addressability error, consider using **AY** to help solve your problem.

2. Many instructions have companions in the RXY-a instruction class. RXY-a instructions all provide 20-bit displacements (range 0 - 1,048,575) instead of 12-bit displacements (range 0 – 4095). For example, SY is the companion Subtract Fullword operation to S.