

# Assignment 1

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Download all Codes from

[https://github.com/Krupateja/EE4013\\_C-DS/blob/main/Codes](https://github.com/Krupateja/EE4013_C-DS/blob/main/Codes)

Download all latex-tikz codes from

[https://github.com/Krupateja/EE4013\\_C-DS/blob/main/ee18btech11015\\_assignment\\_1.tex](https://github.com/Krupateja/EE4013_C-DS/blob/main/ee18btech11015_assignment_1.tex)

## 1 PROBLEM

Consider the following ANSI C Program.

```
z=x + 3 + y->f1 + y->f2;
for (i = 0; i < 200; i = i + 2) { if (z > i)
{
p = p + x + 3;
q = q + y->f1;
} else
{
p = p + y->f2;
q = q + x + 3;
}
}
```

Assume that the variable  $y$  points to a struct (allocated on the heap) containing two fields  $f1$  and  $f2$ , and the local variables  $x$ ,  $y$ ,  $z$ ,  $p$ ,  $q$ , and  $i$  are allotted registers. Common sub-expression elimination (CSE) optimization is applied on the code. The number of addition and the dereference operations (of the form  $y \rightarrow f1$  or  $\rightarrow f2$ ) in the optimized code, respectively, are:

- (A) 403 and 102
- (B) 203 and 2
- (C) 303 and 102
- (D) 303 and 2

## 2 SOLUTION

**Answer:**Option:D

**Explanation**

Optimized code could be:

```
t1 = x + 3 // 1 addition
t2 = y->f1; // 1 dereference
t3 = y->f2; // 1 dereference
z = t1 + t2 + t3 // 2 additions
for (i = 0; i < 200; i += 2) {
    if (z > i) {
        p = p + t1; // 1 addition
        q = q + t2; // 1 addition
    } else {
        p = p + t3; // 1 addition
        q = q + t1; // 1 addition
    }
}
```

Whether we take if or else block we get 2 additions, the loop runs exactly  $200/2=100$  times, so from loop we get  $2 \times 100=200$  additions plus 100 additions for incrementing the value of  $i$  (i.e.,  $i+2$ ), before loop we had performed 3 additions, so total additions 303. We only do two de-reference outside the for loop, so total de-references =2.

So, the number of additions and dereferences are 303 and 2 respectively.