

Verifix user study

Questions Responses 14 Settings

Section 1 of 12

Intelligent Tutoring System Feedback Collection

The goal of the survey is to collect feedback from tutors regarding the usefulness of an intelligent tutoring system (ITS) prototype. The ITS provides personalised programming feedback for novice student programmer in introductory programming course.

The ITS generates feedback in the form of a repaired program that is provably correct, when students submit incorrect solution to a programming assignment.

We prepared 10 incorrect student submissions from a C programming course, arranged according to below themes:
Branching (Assignments 1 - 3)
Loop (Assignments 4 - 6)
Pattern (Assignments 7 - 8)
Array (Assignments 9 - 10)

Data Usage Declaration

The data submitted is anonymized. This anonymized data could be publicly released for research purposes (say in a research publication).

Please confirm your consent with the data usage declaration above. *

- [ ] Yes, I hereby declare my consent.

After section 1 Continue to next section

Section 2 of 12






calculate the area of the triangle

Description:
Write a C program to calculate the area of the triangle formed by the three points (a,b), (a,0) and (0,b), where the coordinates are float and are given by the user.
The output should be in four decimal place.

Input:
1 1

Output:
The area is 0.5000.

Student buggy submission (on the left) and Repaired program (on the right)

```
#include<stdio.h>

int main(){
    float a,b;
    scanf("%f %f",&a,&b);
    float area=(1.0/2)*a*b;
    if (area<0)
        area=-area;
    printf("The area is %.4f",area);


    return 0;
}
```

```
#include<stdio.h>

int main(){
    float a,b,area,newVara1,newVarb1;
    scanf("%f %f",&a,&b);
    newVara1=a;
    newVarb1=b;
    if (a<0)
        newVara1=-a;
    if (b<0)
        newVarb1=-b;
    area=0.5*newVara1*newVarb1;
    printf("The area is %.4f.\n",area);
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

1	2	3	4	5

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 2 Continue to next section

Section 3 of 12

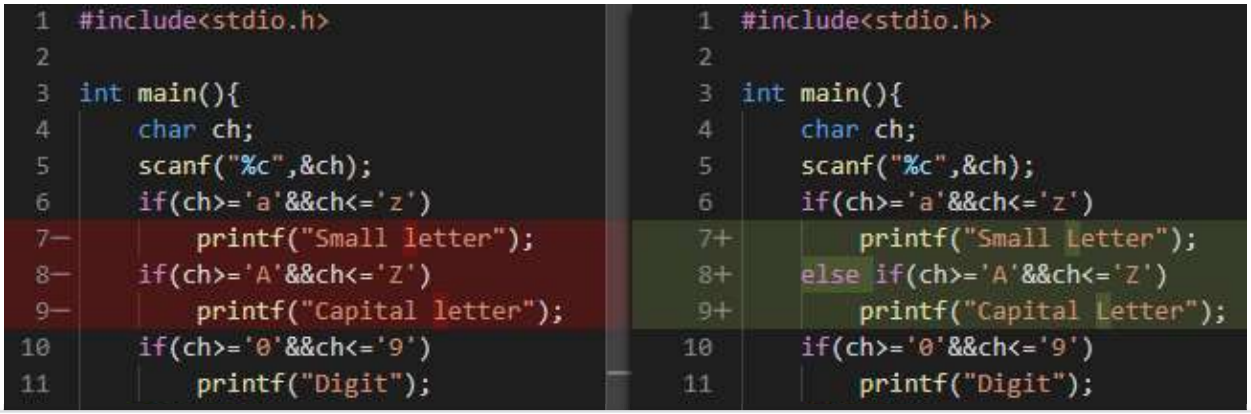
Assignment 2: Write a program to determine whether an input character is a capital letter, a small-case letter, or a

Description:
Write a C program to determine whether an input character is a capital letter, a small-case letter, or a digit. Do not use any library function, like isupper(), islower(), otherwise no marks will be awarded.

Input:
A

Output:
Capital Letter

Student buggy submission (on the left) and Repaired program (on the right)



```
#include<stdio.h>

int main(){
    char ch;
    scanf("%c",&ch);
    if(ch>='a'&&ch<='z')
        printf("Small letter");
    if(ch>='A'&&ch<='Z')
        printf("Capital letter");
    if(ch>='0'&&ch<='9')
        printf("Digit");
```

```
#include<stdio.h>

int main(){
    char ch;
    scanf("%c",&ch);
    if(ch>='a'&&ch<='z')
        printf("Small Letter");
    else if(ch>='A'&&ch<='Z')
        printf("Capital Letter");
    if(ch>='0'&&ch<='9')
        printf("Digit");
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 3 Continue to next section

Section 4 of 12

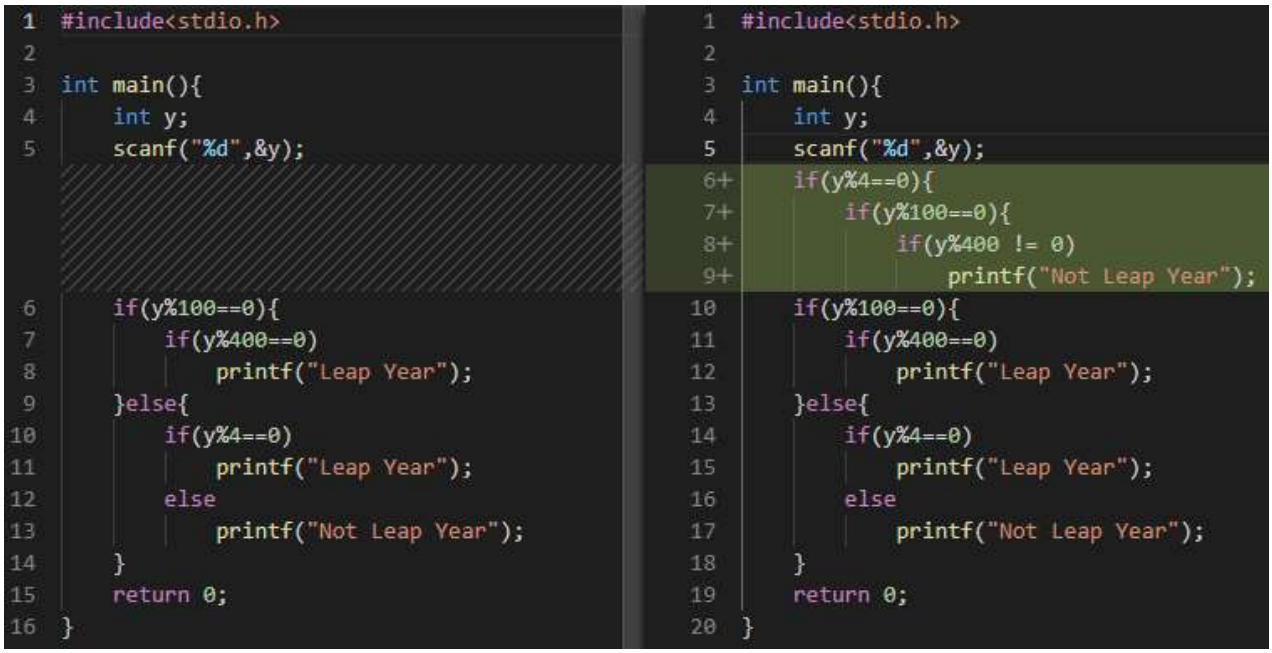
Assignment 3: Write a program to determine whether the year is a leap year or not.

Description:
A year is given as input.
Write a program to determine whether the year is a leap year or not

Input:
2004

Output:

Student buggy submission (on the left) and Repaired program (on the right)



```c
#include<stdio.h>

int main(){
    int y;
    scanf("%d",&y);
    if(y%100==0){
        if(y%400==0)
            printf("Leap Year");
    }else{
        if(y%4==0)
            printf("Leap Year");
        else
            printf("Not Leap Year");
    }
    return 0;
}
```

```c
#include<stdio.h>

int main(){
    int y;
    scanf("%d",&y);
    if(y%4==0){
        if(y%100==0){
            if(y%400 != 0)
                printf("Not Leap Year");
    if(y%100==0){
        if(y%400==0)
            printf("Leap Year");
    }else{
        if(y%4==0)
            printf("Leap Year");
        else
            printf("Not Leap Year");
    }
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 4 Continue to next section

Section 5 of 12

Assignment 4: Write a program to print the reversed number

Description:
You would be given a positive integer as an input. Write a program which prints the reversed number.

Input:
12345

Output:
Reverse of 12345 is 54321

Student buggy submission (on the left) and Repaired program (on the right)

```
1  #include<stdio.h>
2
3  int main(){
4      int a,b,c=0,e;
5      scanf("%d",&a);
6      printf("%d ",a);
7      while(a>0){
8          b=a%10;
9          c=c*10+b;
10         a=a/10;
11     }
12     printf("Reverse of %d is %d",e,c);
13     return 0;
14 }
```

```
1  #include<stdio.h>
2
3  int main(){
4      int a,b=0,c,e;
5      scanf("%d",&a);
6      c=a;
7      while(a>0){
8          b=b*10;
9          b=b+a%10;
10         a=a/10;
11     }
12     printf("Reverse of %d is %d",c,b);
13     return 0;
14 }
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 5 Continue to next section

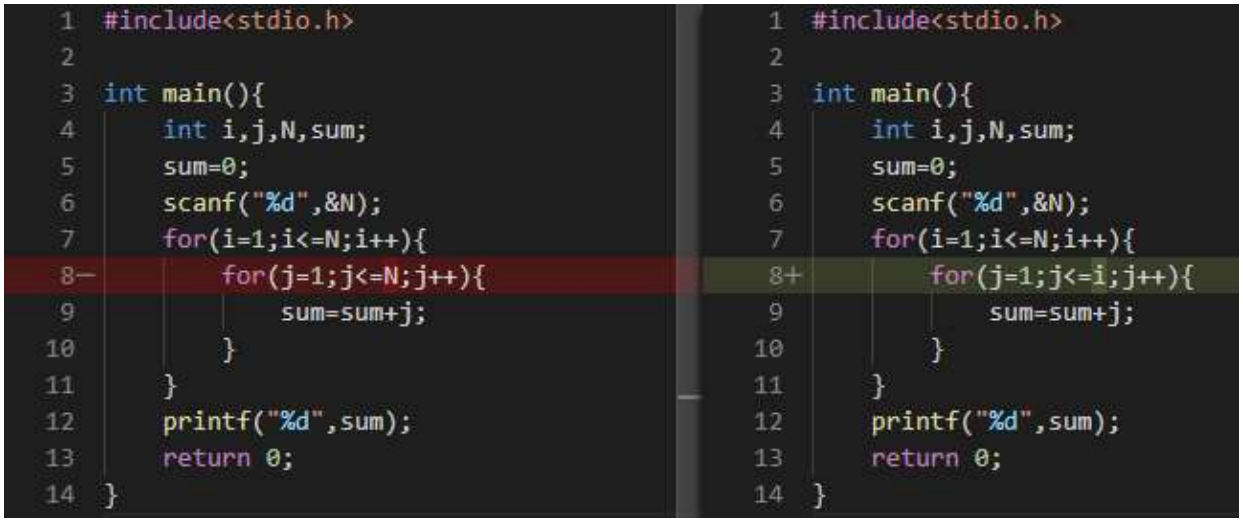
Section 6 of 12

Assignment 5: Write a program to print the Nth tetrahedral number

Description:
Given an input N(N>0), your program should output the Nth tetrahedral number. To calculate the nth tetrahedral number, T(n), the formula is as following:
T(n) = (1) + (1+2) + (1+2+3) + (1+2+3+4) + ... + (1+2+3+4+...+n)

Input:
5

Output:
35



```
#include<stdio.h>

int main(){
    int i,j,N,sum;
    sum=0;
    scanf("%d",&N);
    for(i=1;i<=N;i++){
        for(j=1;j<=N;j++){
            sum=sum+j;
        }
    }
    printf("%d",sum);
    return 0;
}
```

```
#include<stdio.h>

int main(){
    int i,j,N,sum;
    sum=0;
    scanf("%d",&N);
    for(i=1;i<=N;i++){
        for(j=1;j<=i;j++){
            sum=sum+j;
        }
    }
    printf("%d",sum);
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 6 Continue to next section

Section 7 of 12

Assignment 6: Write a program to print prime number within a range

Description:
Given two positive integers, n1 and n2, output all the prime numbers between (and including) n1 and n2, separated by a space each.

Input:
11 20

Output:
11 13 17 19

Student buggy submission (on the left) and Repaired program (on the right)

```
#include<stdio.h>

int check_prime(int num){
    int j;


    for(j=2;j<num;j++){
        if(num%j==0){
            return 0;
        }
    }
    return num;
}

int main(){
    int a,n1,n2,num;
    scanf("%d %d",&n1,&n2);
    for(num=n1;num<=n2;num++){
       a=check_prime(num);
       if(a!=0)
       printf("%d ",num);
    }
    return 0;
}
```

```
#include<stdio.h>

int check_prime(int num){
    int j,newVarflag=0;
    if(num==1)
        return 1;
    for(j=2;j<=num/2;j++){
        if(num%j==0){
            newVarflag=1;
            break;
        }
    }
    return newVarflag;
}

int main(){
    int a,n1,n2,num;
    scanf("%d %d",&n1,&n2);
    for(num=n1;num<=n2;num++){
        a=check_prime(num);
        if(a==0)
            printf("%d ",num);
    }
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

1 2 3 4 5

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 7 Continue to next section

Section 8 of 12

Assignment 7: Write a program to print pattern 1

Description:
Given an integer N(N>0) as input, your program should output the following pattern.

Input :
5

Output:
5432*
543*1
54*21
5*321
*4321

```c
#include<stdio.h>

int main(){
    int a,n,N,i,j;//N as an input
    scanf("%d",&N);

    for(j=1;j<=N;j=j+1){
      for(i=1;i<=N;i=i+1){

        if(i+j==6)
          printf("*");
        else{
          a=N+1-i;
          printf("%d",a);
        }
      }

      printf("\n");
    }

    return 0;
}
```

```c
#include<stdio.h>

int main(){
    int a,n,N,i,j;//N as an input
    scanf("%d",&N);

    for(j=1;j<=N;j=j+1){
      for(i=N;i>=1;i=i-1){

        if(i==j)
          printf("*");
        else{

          printf("%d",a);
        }
      }

      printf("\n");
    }

    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

1	2	3	4	5

After section 8 Continue to next section

Section 9 of 12

Assignment 8: Write a program to print pattern 2

Description:
Given an input number N(0<=N<=9), a width w and height h,respectively,generate a rectangle boundary space as shown below:

Input:
3 4 5

Output:
3333
3 3
3 3
3 3
3333

Student buggy submission (on the left) and Repaired program (on the right)

```
1  #include<stdio.h>
2
3  int main(){
4      int N,w,h;
5      scanf("%d%d%d",&N,&w,&h);
6      int a,b;
7      for(b=1;b<=h;b++){
8          for(a=1;a<=w;a++){
9-             if(a==1){
10                 printf("%d",N);
11-            }else if(a==w){
12-                printf("%d",N);
13-                printf("\n");
14             }else{
15                 printf(" ");
16             }
17         }
18     }
19     return 0;
20 }
```

```
1  #include<stdio.h>
2
3  int main(){
4      int N,w,h;
5      scanf("%d%d%d",&N,&w,&h);
6      int a,b;
7      for(b=1;b<=h;b++){
8          for(a=1;a<=w;a++){
9+             if(a==w||a==1||b==1||b==h){
10                 printf("%d",N);
11             }else{
12                 printf(" ");
13             }
14         }
15+        printf("\n");
16     }
17     return 0;
18 }
```

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 9 Continue to next section

Section 10 of 12

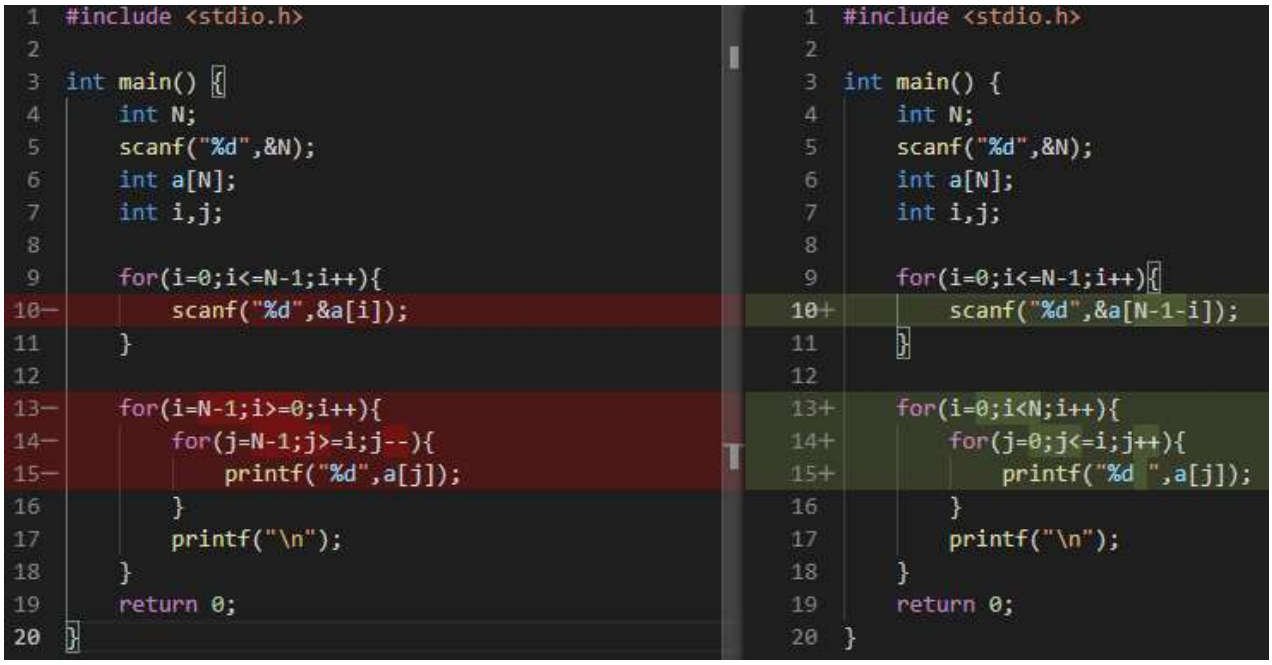
Assignment 9: Write a program to print array reversely

Description:
Given a number N, and an array a[0...N-1] which has N numbers, print the following -

a[N-1]
a[N-1] [N-2]
a[N-1] a[N-2] a[N-3]
....
.....
a[N-1] a[N-2] .... a[0]

Output:
100
100 65
100 65 72
100 65 72 91
100 65 72 91 52

Student buggy submission (on the left) and Repaired program (on the right)



```
#include <stdio.h>

int main() {
    int N;
    scanf("%d",&N);
    int a[N];
    int i,j;

    for(i=0;i<=N-1;i++){
        scanf("%d",&a[i]);
    }

    for(i=N-1;i>=0;i++){
        for(j=N-1;j>=i;j--){
            printf("%d",a[j]);
        }
        printf("\n");
    }
    return 0;
}
```

```
#include <stdio.h>

int main() {
    int N;
    scanf("%d",&N);
    int a[N];
    int i,j;

    for(i=0;i<=N-1;i++){
        scanf("%d",&a[N-1-i]);
    }

    for(i=0;i<N;i++){
        for(j=0;j<=i;j++){
            printf("%d ",a[j]);
        }
        printf("\n");
    }
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

After section 10 Continue to next section

Section 11 of 12

Assignment 10: Write a program to check whether an array has duplicate

Description:
Given an integer array, detect if it contains duplicate elements.

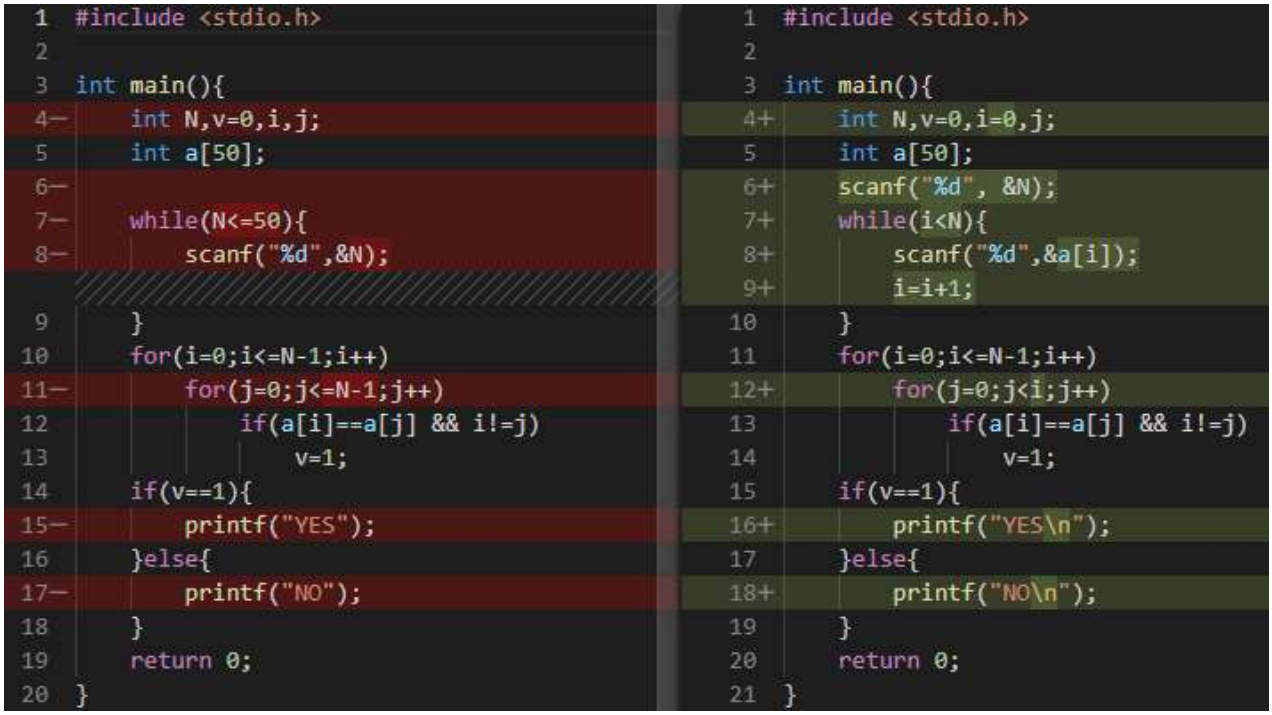
Input Specification:
First line contains size N of the array.
Next line contains N space separated integers giving the contents of the array.

Output Format:
Output YES or NO (followed by a newline).

Input:
4
34 13 42 13

Output:
YES

Student buggy submission (on the left) and Repaired program (on the right)



```
#include <stdio.h>

int main(){
    int N,v=0,i,j;
    int a[50];

    while(N<=50){
        scanf("%d",&N);

    }
    for(i=0;i<=N-1;i++)
        for(j=0;j<=N-1;j++)
            if(a[i]==a[j] && i!=j)
                v=1;
    if(v==1){
        printf("YES");
    }else{
        printf("NO");
    }
    return 0;
}
```

```
#include <stdio.h>

int main(){
    int N,v=0,i=0,j;
    int a[50];
    scanf("%d", &N);
    while(i<N){
        scanf("%d",&a[i]);
        i=i+1;
    }
    for(i=0;i<=N-1;i++)
        for(j=0;j<i;j++)
            if(a[i]==a[j] && i!=j)
                v=1;
    if(v==1){
        printf("YES\n");
    }else{
        printf("NO\n");
    }
    return 0;
}
```

Rate the quality of the generated repair (in terms of semantic correctness, size, etc) *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair (either complete or partial) as feedback to the student *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Rate the possibility that you would like to use the repair indirectly: to help formulate your own custom feedback to student *

1	2	3	4	5
○	○	○	○	○

After section 11 Continue to next section

Section 12 of 12

Summary

Final Questions!

Rate the possibility that these repairs can help you in grading *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Will examples of student incorrect submissions and repairs like these help you in improving the grading policy? *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

If the repair is known to be verifiably (provably) correct, does it give you more confidence in using it? *

	1	2	3	4	5	
Very Low	○	○	○	○	○	Very High

Can you share your feedback regarding ITS (Optional)

Short answer text