LAB_7 IT314

USING GITHUB CODES & JAVA PROGRAMS CODE INSPECTION, DEBUGGING & STATIC ANALYSIS TOOL

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Program Inspection/Debugging for Long-code from GitHub

We are given the following checklist and we have to find all the possible errors accordingly,

1. Data referencing Errors
2. Data declaration Errors
3. Computation Errors
4. Comparison Errors
5. Control Flow errors
6. Interface errors
7. Input/Output Errors
8. Other Checks

Category A: Data Reference Errors

- **File Handling:**
  There are no immediate signs of file operations in the observed portion, but the presence of libraries like `PIL` and `os` suggests that the program might involve file handling later in the code (possibly for images). Ensure that proper error handling mechanisms are implemented when opening, manipulating, or saving files (images). If files like images are opened, ensure they are closed correctly, or use context managers (`with` statements) to handle these files.

Category B: Data Declaration Errors

- **Data Initialization:**
  Variables like `data.mode`, `data.prevmode`, and animation positions (e.g., `data.Anim1X1`, `data.Anim1Y1`) are initialized explicitly. However, ensure that other variables used later in the program are similarly initialized to prevent any undefined behavior or errors from using uninitialized data.

Category C: Computation Errors

- **Mathematical and Data Calculations:**
  There are mathematical operations involved, such as initializing animation positions. Ensure that the calculations related to image dimensions or positions (e.g., `data.Anim1X1`, `data.Anim1Y1`) are valid and take into account possible edge cases like division by zero or negative coordinates when manipulating images.

Category E: Control-Flow Errors

- **Excessive Use of Goto Statements:**
  Python does not support `goto` statements, and there are no control-flow issues apparent in the current portion. The control flow appears well-organized, with functions handling different aspects of the program such as loading backgrounds and animations. Ensure the logic remains clear throughout the file by using appropriate loops or conditional statements to avoid over-complication.

Category G: Input/Output Errors

- **Inconsistent File Closing:**
  Since the program seems to work with images, proper management of file handling is crucial. Although no direct file I/O operations are seen in this portion, if files (e.g., images) are opened and manipulated later in the code, ensure that they are properly closed or handled with context managers to prevent resource leaks.

DEBUGGING:

1. Armstrong Number Program

- **Error**: Incorrect computation of the remainder.
- **Fix**: Use breakpoints to check the remainder calculation.

Corrected Code:

```
class Armstrong {
 public static void main(String args[]) {
 int num = Integer.parseInt(args[0]);
 int n = num, check = 0, remainder;
 while (num > 0) {
 remainder = num % 10;
 check += Math.pow(remainder, 3);
 num/= 10;
 }
 if (check == n) {
 System.out.println(n + " is an Armstrong Number");
 } else {
 System.out.println(n + " is not an Armstrong Number");
 }
 }
```

2. GCDandLCMProgram

- Errors:

1. Incorrect while loop condition in GCD.
2. Incorrect LCM calculation logic.

- Fix:

Breakpoints at the GCD loop and LCM logic.

Corrected Code:

```
import java.util.Scanner;
public class GCD_LCM {
static int gcd(int x, int y) {
while (y != 0) {
int temp = y;
y = x%y;
x =temp;
}
return x;
}
static int lcm(int x, int y) {
return (x * y) / gcd(x, y);
}
public static void main(String args[]) {
Scanner input = new Scanner(System.in);
System.out.println("Enter the two numbers: ");
int x = input.nextInt();
int y = input.nextInt();
System.out.println("The GCD of two numbers is: " + gcd(x, y));
System.out.println("The LCM of two numbers is: " + lcm(x, y));
```

```
input.close();
}
}
```

3. Knapsack Program

● Error: Incrementing n inappropriately in the loop.

● Fix: Breakpoint to check loop behavior.

Corrected Code:

```
public class Knapsack {
public static void main(String[] args) {
int N = Integer.parseInt(args[0]);
int W=Integer.parseInt(args[1]);
int[] profit = new int[N + 1], weight = new int[N + 1];
int[][] opt = new int[N + 1][W + 1];
boolean[][] sol = new boolean[N + 1][W + 1];
for (int n = 1; n <= N; n++) {
for (int w = 1; w <= W; w++) {
int option1 = opt[n- 1][w];
int option2 = (weight[n] <= w) ? profit[n] + opt[n- 1][w- weight[n]] :
Integer.MIN_VALUE;
opt[n][w] = Math.max(option1, option2);
sol[n][w] = (option2 > option1);
}
}
}
}
```

4. Magic Number Program

● Errors:

1. Incorrect condition in the inner while loop.
2. Missing semicolons in expressions.

● Fix:

Set breakpoints at the inner while loop and check variable values.

Corrected Code:

```
import java.util.Scanner;
public class MagicNumberCheck {
public static void main(String args[]) {
Scanner ob = new Scanner(System.in);
System.out.println("Enter the number to be checked.");
int n = ob.nextInt();
int sum = 0, num =n;
while (num > 9) {
sum=num;
int s = 0;
while (sum > 0) {
s = s* (sum / 10); // Fixed missing semicolon
sum=sum%10;
}
num=s;
}
if (num == 1) {
System.out.println(n + " is a Magic Number.");
} else {
System.out.println(n + " is not a Magic Number.");
```

```
}
}
```

5. Merge Sort Program

● Errors:

1. Incorrect array splitting logic.
2. Incorrect inputs for the merge method.

● Fix: Breakpoints at array split and merge operations.

Corrected Code:

```
import java.util.Scanner;
public class MergeSort {
public static void main(String[] args) {
int[] list = {14, 32, 67, 76, 23, 41, 58, 85};
System.out.println("Before: " + Arrays.toString(list));
mergeSort(list);
System.out.println("A er: " + Arrays.toString(list));
}
public static void mergeSort(int[] array) {
if (array.length > 1) {
int[] le = le Half(array);
int[] right = rightHalf(array);
mergeSort(le );
mergeSort(right);
merge(array, le , right);
}
}
public static int[] le Half(int[] array) {
int size1 = array.length / 2;
```

```
int[] le = new int[size1];
System.arraycopy(array, 0, le , 0, size1);
return le ;
}
public static int[] rightHalf(int[] array) {
int size1 = array.length / 2;
int size2 = array.length- size1;
int[] right = new int[size2];
System.arraycopy(array, size1, right, 0, size2);
return right;
}
public static void merge(int[] result, int[] le , int[] right) {
int i1 = 0, i2 = 0;
for (int i = 0; i < result.length; i++) {
if (i2 >= right.length || (i1 < le .length && le [i1] <= right[i2])) {
result[i] = le [i1];
i1++;
} else {
result[i] = right[i2];
i2++;
}
}
}
}
```

6. Multiply Matrices Program

● Errors:

1. Incorrect loop indices.
2. Wrong error message.

● Fix: Set breakpoints to check matrix multiplication and correct messages.

Corrected Code:

```
import java.util.Scanner;
class MatrixMultiplication {
public static void main(String args[])
int m, n, p, q, sum = 0, c, d, k;
Scanner in = new Scanner(System.in);
System.out.println("Enter the number of rows and columns of the first matrix");
m=in.nextInt();
n =in.nextInt();
int first[][] = new int[m][n];
System.out.println("Enter the elements of the first matrix");
for (c = 0; c < m; c++)
for (d = 0; d < n; d++)
f
irst[c][d] = in.nextInt();
System.out.println("Enter the number of rows and columns of the second matrix");
p =in.nextInt();
q =in.nextInt();
if (n != p)
```

```
System.out.println("Matrices with entered orders can't be
multiplied.");
else {
int second[][] = new int[p][q];
int multiply[][] = new int[m][q];
System.out.println("Enter the elements of the second matrix");
for (c = 0; c < p; c++)
for (d = 0; d < q; d++)
second[c][d] = in.nextInt();
for (c = 0; c < m; c++) {
for (d = 0; d < q; d++) {
for (k = 0; k < p; k++) {
sum+=first[c][k] * second[k][d];
}
multiply[c][d] = sum;
sum=0;
}
}
System.out.println("Product of entered matrices:");
for (c = 0; c < m; c++) {
for (d = 0; d < q; d++)
System.out.print(multiply[c][d] + "\t");
System.out.print("\n");
}
}
}
```

7. Quadratic Probing Hash Table Program

● Errors:

1. Typos in insert, remove, and get methods.
2. Incorrect logic for rehashing.

● Fix: Set breakpoints and step through logic for insert, remove, and get methods.

Corrected Code:

```
import java.util.Scanner;
class QuadraticProbingHashTable {
private int currentSize, maxSize;
private String[] keys, vals;
public QuadraticProbingHashTable(int capacity) {
currentSize = 0;
maxSize = capacity;
keys = new String[maxSize];
vals = new String[maxSize];
}
public void insert(String key, String val) {
int tmp = hash(key), i = tmp, h = 1;
do {
if (keys[i] == null) {
keys[i] = key;
vals[i] = val;
currentSize++;
return;
}
if (keys[i].equals(key)) {
```

```
vals[i] = val;
return;
}
i += (h * h++) % maxSize;
} while (i != tmp);
}
public String get(String key) {
int i = hash(key), h = 1;
while (keys[i] != null) {
if (keys[i].equals(key))
return vals[i];
i = (i + h * h++) % maxSize;
}
return null;
}
public void remove(String key) {
if (!contains(key)) return;
int i = hash(key), h = 1;
while (!key.equals(keys[i]))
i = (i + h * h++) % maxSize;
keys[i] = vals[i] = null;
}
private boolean contains(String key) {
return get(key) != null;
}
private int hash(String key) {
return key.hashCode() % maxSize;
```

```
}
}
public class HashTableTest {
public static void main(String[] args) {
Scanner scan = new Scanner(System.in);
QuadraticProbingHashTable hashTable = new
QuadraticProbingHashTable(scan.nextInt());
hashTable.insert("key1", "value1");
System.out.println("Value: " + hashTable.get("key1"));
}
}
```

8. Sorting Array Program

● Errors:

1. Incorrect class name with an extra space.
2. Incorrect loop condition and extra semicolon.

● Fix: Set breakpoints to check the loop and class name.

Corrected Code:

```
import java.util.Scanner;
public class AscendingOrder {
public static void main(String[] args) {
int n, temp;
Scanner s = new Scanner(System.in);
System.out.print("Enter the number of elements: ");
n =s.nextInt();
int[] a = new int[n];
System.out.println("Enter all the elements:");
for (int i = 0; i < n; i++) a[i] = s.nextInt();
```

```
for (int i = 0; i < n; i++) {
for (int j = i + 1; j < n; j++) {
if (a[i] > a[j]) {
temp = a[i];
a[i] = a[j];
a[j] = temp;
}
}
}
System.out.println("Sorted Array: " + Arrays.toString(a));
}
}
```

9. Stack Implementation Program

● Errors:

1. Incorrect top-- instead of top++ in push.
2. Incorrect loop condition in display.
3. Missing pop method.

● Fix: Add breakpoints to check push, pop, and display methods.

Corrected Code:

```
public class StackMethods {
private int top;
private int[] stack;
public StackMethods(int size) {
stack = new int[size];
top =-1;
}
```

```
public void push(int value) {
if (top == stack.length- 1) {
System.out.println("Stack full");
} else {
stack[++top] = value;
}
}
public void pop() {
if (top ==-1) {
System.out.println("Stack empty");
} else {
top--;
}
}
public void display() {
for (int i = 0; i <= top; i++) {
System.out.print(stack[i] + " ");
}
System.out.println();
}
}
```

10. Tower of Hanoi Program

- Error: Incorrect increment/decrement in recursive call.
- Fix: Breakpoints at the recursive calls to verify logic.

Corrected Code:

```
public class TowerOfHanoi {
```

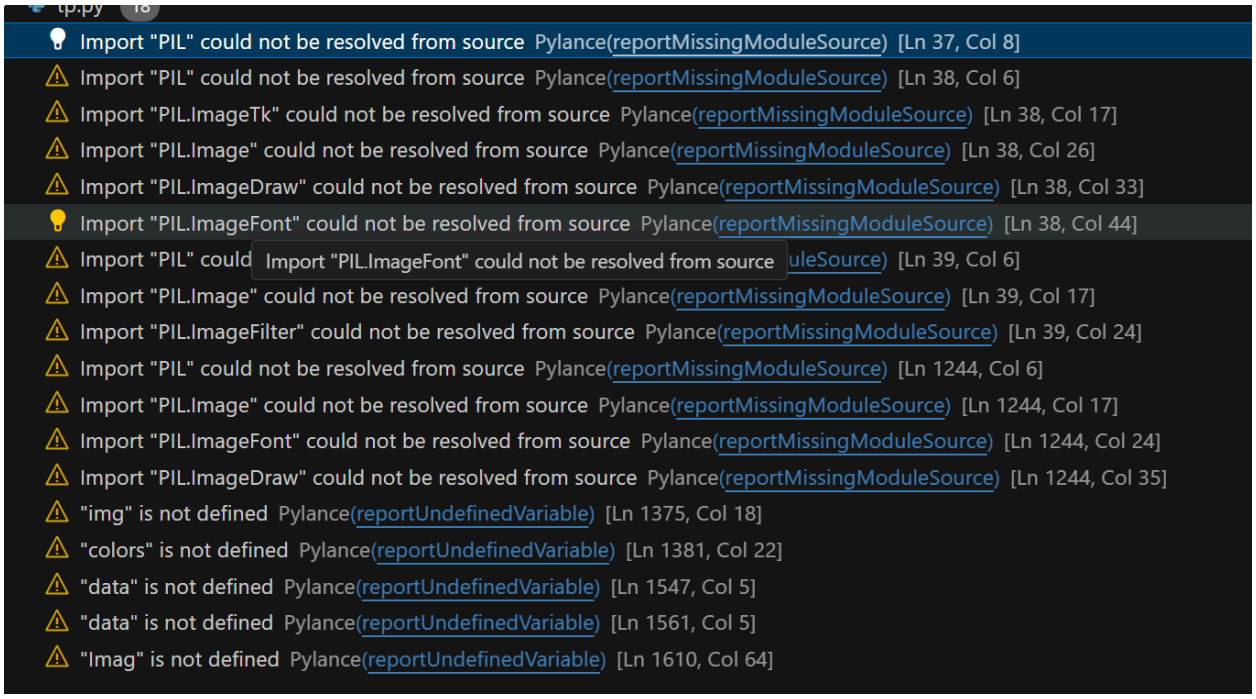
```
public static void main(String[] args) {
int nDisks = 3;
doTowers(nDisks, 'A', 'B', 'C');
}
public static void doTowers(int topN, char from, char inter, char to) {
if (topN == 1) {
System.out.println("Disk 1 from " + from + " to " + to);
} else {
doTowers(topN- 1, from, to, inter);
System.out.println("Disk " + topN + " from " + from + " to " + to);
doTowers(topN- 1, inter, from, to);
}
}
```

<u>Static Analysis Tool:</u>

Below are the results after performing static analysis on tp.py file

```
PS C:\Users\dharm\Desktop\SEM 5\SE\Testing_lab>  & 'c:\Python312\python.exe'
'c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\adapter/../..\debugpy\launcher' '51549' '--'
'C:\Users\dharm\Desktop\SEM 5\SE\Testing_lab\tp.py'
Traceback (most recent call last):
  File "c:\Python312\Lib\runpy.py", line 198, in _run_module_as_main
    return _run_code(code, main_globals, None,
           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File "c:\Python312\Lib\runpy.py", line 88, in _run_code
    exec(code, run_globals)
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\adapter/../..\debugpy\launcher/../..\debugpy\__main__.py", line
39, in <module>
    cli.main()
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\adapter/../..\debugpy\launcher/../..\debugpy/..\debugpy\server\cli.
py", line 430, in main
    run()
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\adapter/../..\debugpy\launcher/../..\debugpy/..\debugpy\server\cli.
py", line 284, in run_file
    runpy.run_path(target, run_name="__main__")
```

```
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\_vendored\pydevd\_pydevd_bundle\pydevd_runpy.py", line
321, in run_path
    return _run_module_code(code, init_globals, run_name,
           ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\_vendored\pydevd\_pydevd_bundle\pydevd_runpy.py", line
135, in _run_module_code
    _run_code(code, mod_globals, init_globals,
  File
"c:\Users\dharm\.vscode\extensions\ms-python.debugpy-2024.10.0-win32-x64\bun
dled\libs\debugpy\_vendored\pydevd\_pydevd_bundle\pydevd_runpy.py", line
124, in _run_code
    exec(code, run_globals)
  File "C:\Users\dharm\Desktop\SEM 5\SE\Testing_lab\tp.py", line 37, in
<module>
    import PIL
ModuleNotFoundError: No module named 'PIL'
```


tp.py 18
Import "PIL" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 37, Col 8]
Import "PIL" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 38, Col 6]
Import "PIL.ImageTk" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 38, Col 17]
Import "PIL.Image" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 38, Col 26]
Import "PIL.ImageDraw" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 38, Col 33]
Import "PIL.ImageFont" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 38, Col 44]
Import "PIL" could
Import "PIL.ImageFont" could not be resolved from source
uleSource) [Ln 39, Col 6]
Import "PIL.Image" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 39, Col 17]
Import "PIL.ImageFilter" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 39, Col 24]
Import "PIL" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 1244, Col 6]
Import "PIL.Image" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 1244, Col 17]
Import "PIL.ImageFont" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 1244, Col 24]
Import "PIL.ImageDraw" could not be resolved from source Pylance(reportMissingModuleSource) [Ln 1244, Col 35]
"img" is not defined Pylance(reportUndefinedVariable) [Ln 1375, Col 18]
"colors" is not defined Pylance(reportUndefinedVariable) [Ln 1381, Col 22]
"data" is not defined Pylance(reportUndefinedVariable) [Ln 1547, Col 5]
"data" is not defined Pylance(reportUndefinedVariable) [Ln 1561, Col 5]
"Imag" is not defined Pylance(reportUndefinedVariable) [Ln 1610, Col 64]