

## 4. DEBUGGING

### How to Fix a Bug

#### Read the Error Message

If the bug is producing an error message, that's great, read it carefully. The error messages generally can give us a clue as to what the issue might be, or at least where to start looking from. It can also be incredibly useful for us to put the error message into Google, and search for it; we will often find that someone else has experienced this same bug and has found a solution.

#### Beware of Side-Effects

Fixing a bug should be done very carefully, if the fix is done poorly, it can introduce other issues into the RegEx, and do more harm than good, so it's important to be careful when fixing bugs. American software engineer Tom Van Vleck outlined three simple questions that we should ask ourselves before making a fix:

1. *Is this bug (or a similar bug) likely to appear in another RegEx?*  
In many cases a programmer will use the same type of logic throughout multiple RegExes, so if an error is found in one RegEx, it may be worth reflecting on whether or not there are other RegExes that has similar functionality.
2. *What new issue might be introduced into the RegEx when fixing the bug?*  
Before the bug is fixed, it is a good idea to explore the design of the RegEx (and the program around it), to check the context in which the RegEx is being used in. If it depends on other programs or RegExes, then it is important to carefully check what the consequences could be of any changes made.
3. *What can be done to prevent this same bug from happening again?*  
This is the first step in creating a good Software Quality Assurance Process going forward. If there was a problem in the development process that caused the bug to occur, fixing that issue with the process will prevent similar bugs from occurring in the future.

#### Other Terms for Bugs

Depending on who is discussing bugs, they may use different terms to describe them, so for example, someone in IT Sales might call them *features*, whereas an IT Tester might call them *issues*. Here are some other terms for bugs:

<b><i>Defects</i></b>	<b><i>Faults</i></b>	<b><i>Problems</i></b>	<b><i>Incidents</i></b>
<b><i>Anomalies</i></b>	<b><i>Inconsistencies</i></b>	<b><i>Variances</i></b>	<b><i>Failures</i></b>
<b><i>Mistakes</i></b>	<b><i>Exceptions</i></b>	<b><i>Errors</i></b>	<b><i>Side Effects</i></b>

This is a small sampling of the range of terms used for bugs.