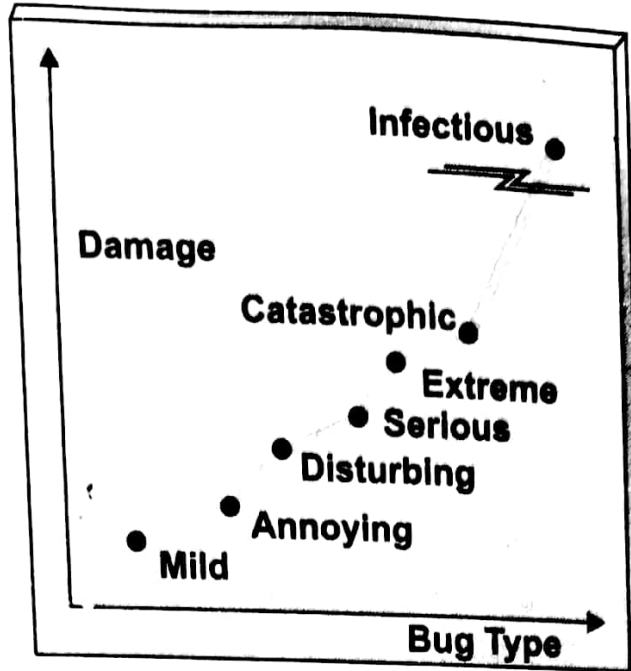


## 6.10.1 The Debugging Process

During debugging, errors are encountered that range from less damaging (like input of an incorrect function) to catastrophic (like system failure, which lead to economic or physical damage). Various levels of errors and their damaging effects are shown in Figure 6.38. Note that with the increase in number of errors, the amount of effort to find their causes also increases.

Once errors are identified in a software system, to debug the problem, a number of steps are followed, which are listed below.

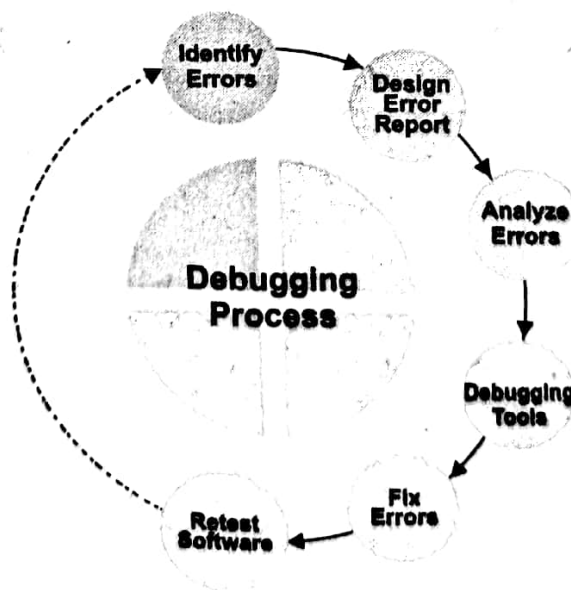
1. ***Defect confirmation/identification:*** A problem is identified in a system and a defect report is created. A software engineer maintains and analyzes this error report and finds solutions to the following questions.
  - Does a defect exist in the system?
  - Can the defect be reproduced?
  - What is the expected/desired behavior of the system?
  - What is the actual behavior?



**Figure 6.38** Levels of Error and its Damaging Effect

2. **Defect analysis:** If the defect is genuine, the next step is to understand the root cause of the problem. Generally, engineers debug by starting a debugging tool (debugger) and they try to understand the root cause of the problem by following a step-by-step execution of the program.
3. **Defect resolution:** Once the root cause of a problem is identified, the error can be resolved by making an appropriate change to the system by fixing the problem.

When the debugging process ends, the software is retested (as shown in Figure 6.39) to ensure that no errors are left undetected. Moreover, it checks that no new errors are introduced in the software while making some changes to it during the debugging process.



**Figure 6.39** Debugging Process