

Chapter  
1

# INTRODUCTION

*Get on the  
Fast Track!*

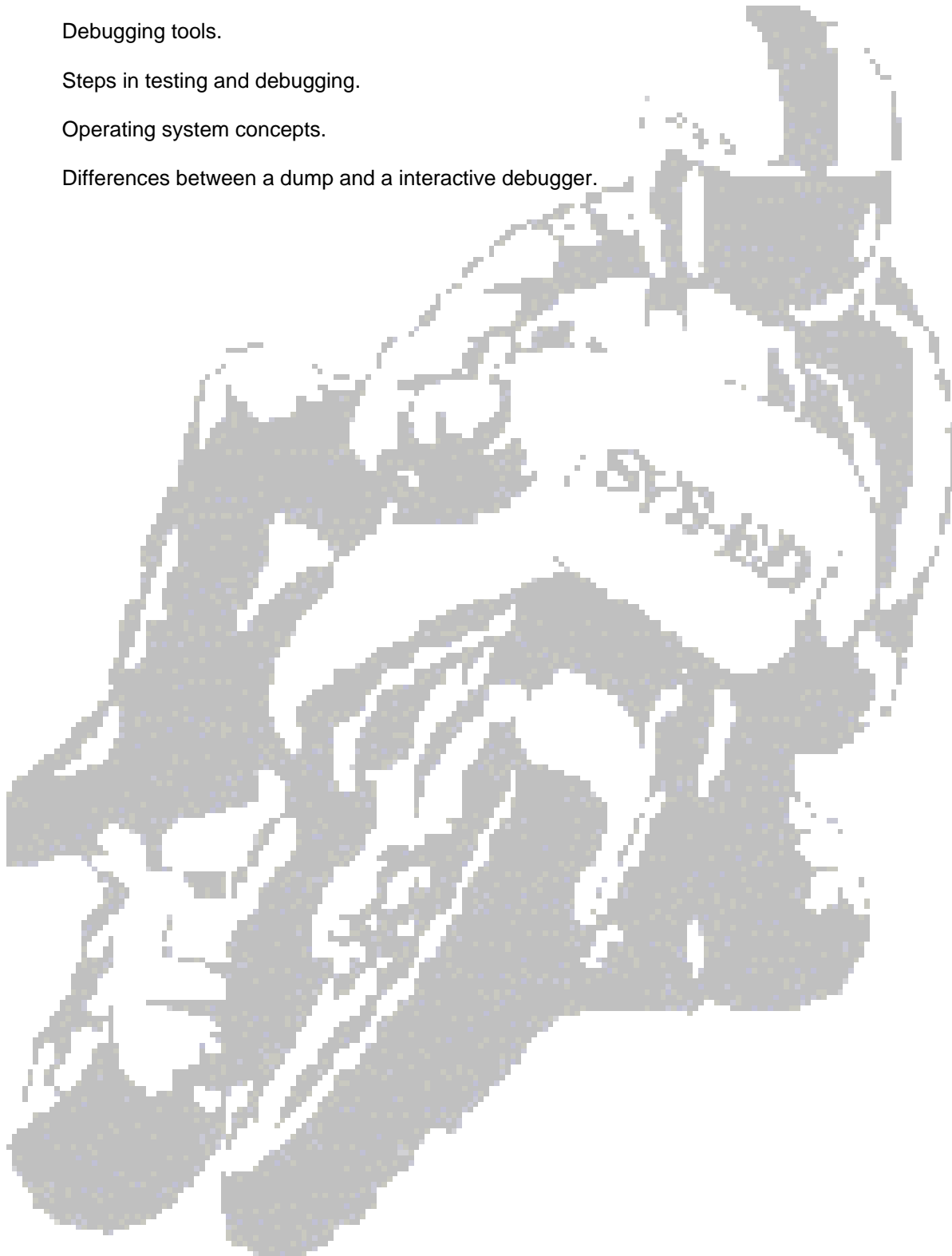


**SYS-ED/  
COMPUTER  
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**Objectives**

You will learn:

- C Debugging tools.
- C Steps in testing and debugging.
- C Operating system concepts.
- C Differences between a dump and a interactive debugger.



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## 1 Debugging - Definitions

"Removing a bug, either by tinkering with the program or by amending the program specifications so that the side effect of the bug is published as a desirable feature."

Stan Kelly-Bootle, The Devil's DP Dictionary

The art of finding a problem in a program.

The symptom of a bug may be one of the following:

- C Program takes too long (ie. loop).
- C Incorrect results.
- C Program terminates with a program error.
- C Program terminates with a system error.

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## 2 Why Test?

Testing is needed in order to confirm that the program is correct.

This includes:

- C Running the program to completion.
- C Checking that the program does what it is supposed to.
- C Confirming that the right performance level has been achieved.

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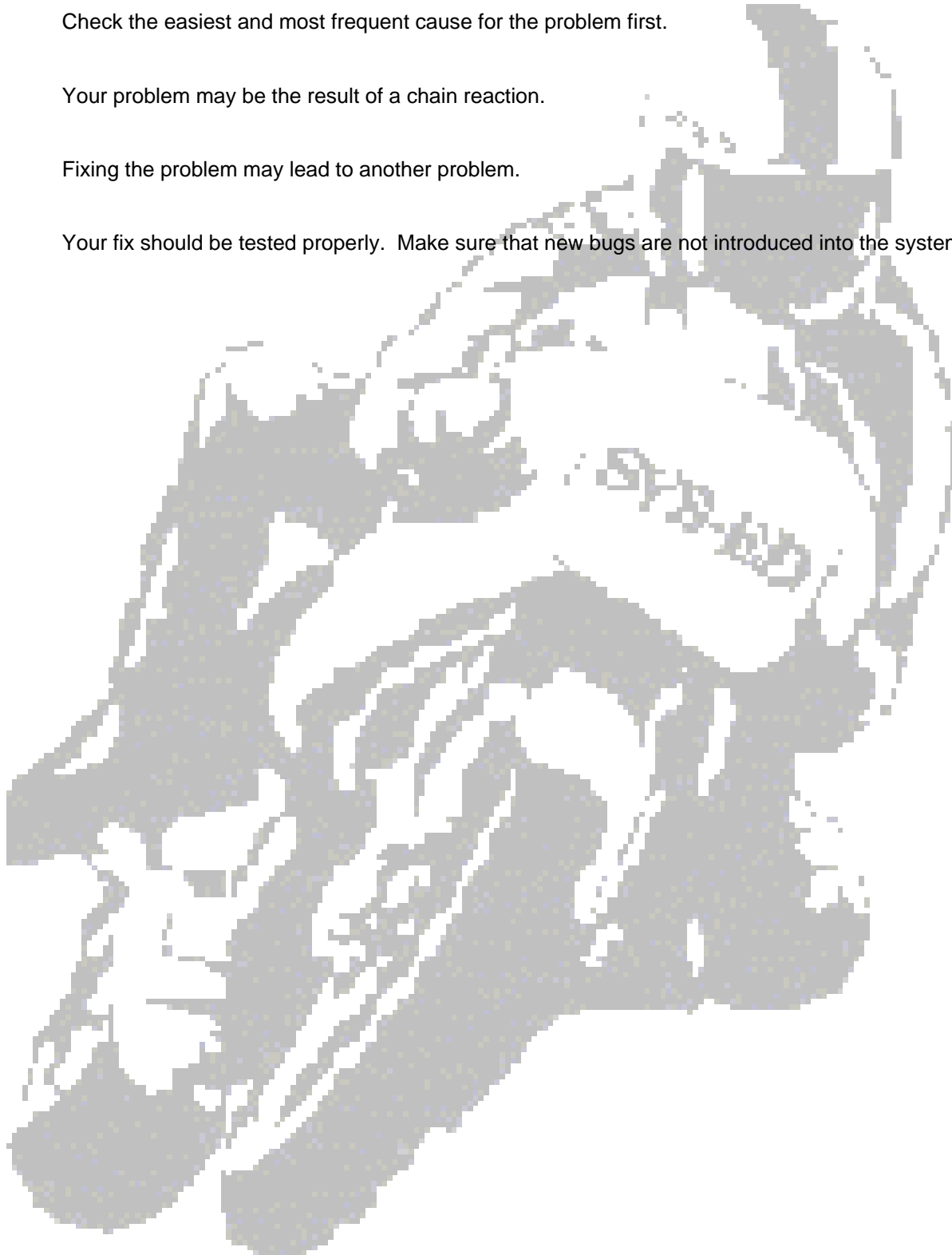
### 3 Steps in Debugging

1. Do not assume anything, except that you have a problem.
2. Determine the System Completion Code (SCC).
3. Develop an explanation of the abend using the diagnostics.
4. Collect additional information:
  - C Source Listings (Most current)
  - C Linkage Editor Map
  - C JES Job Log
  - C Program Output
  - C Program Input
  - C ABEND Dump
  - C Program Documentation (if it exists)
5. Determine the source statement that caused the error.
6. Determine the values of any data items associated with the error.
7. Examine the collected items.
8. Attempt a desk check simulation of program execution.
9. Trace the execution using debugging tools.
10. Review alternative solutions.
11. Verify the correction.

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## 4 Guidelines

- C Check the easiest and most frequent cause for the problem first.
- C Your problem may be the result of a chain reaction.
- C Fixing the problem may lead to another problem.
- C Your fix should be tested properly. Make sure that new bugs are not introduced into the system.



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**5 Manuals and Books**

- C COBOL Programmer Guide - IBM
- C System/370 Reference Summary - IBM
- C VS COBOL II Debugging Guide - IBM
- C Principles of Operation - IBM
- C Debugging Handbook - IBM
- C System Messages and Codes - IBM
- C Application Programming by Robert Binder
- C OS Debugging for the COBOL Programmer by Wayne Clary

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## 6 Operating System Concepts

### Function of an Operating System

The Operating System (O/S) is software that controls the equipment resources such as CPU, memory, secondary storage. The O/S resolves conflicts, optimizes performance, and simplifies the use of the system.

### Supervisor, Problem and Wait State

There are a group of instructions which are usually not available to the ordinary user, commonly called *privileged instructions*. In the *supervisor state*, you can execute privileged instructions, such as changing the state, changing the protection rights of memory, or start an I/O process. During the *problem state*, often called the *program state*, the system is executing your instructions.

The *wait state* implies that the program is waiting for some resource to become available.

### Virtual Storage

The ability for the computer to address space that is greater than real memory. The size that could be addressed by your program is called the *address space*.

An address is a location in the computer. Under MVS, there are two size addresses, 3 byte (24 bit) and 31 bit. The 3 byte address is mainly discussed in this course.

When the O/S system loads your job into the computer, it is placed into your region. The region is the amount of memory available to your job.

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## 7 File Management

The file management portion of the O/S controls access and protection of the various file structures.

There are basically 3 types of data sets discussed in this class:

1. QSAM Queued Sequential Data Set
2. BPAM Basic Partitioned Data Set (PDS or Library)
3. Under VSAM there are four type of data sets:
  - C KSDS: Keyed Sequential Data Set
  - C RRDS: Relative Record Data Set
  - C ESDS: Entry Sequence Data Set
  - C VSAM Linear Storage Data Set

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## 8 Compile/Link Editor

### Compile Process

Reads your source code and checks for syntax errors. It produces the following outputs:

- C Object Module
- C Source Listing
- C Reference Listing (ie: XREF, PMAP/LIST, DMAP/MAP, etc.)

### Linkage Editor Process

Reads your object module and resolves external references.

This utility creates a load module and prints a load module map.

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## 9 JCL: Job Control Language

The JCL tells the O/S what jobs are to be run, what data sets are associated with each program (job step), amount of memory for the job and accounting information.

### Multitasking

This allows the system to run a number of tasks at the same time.

- C A task is a unit of work that the system can run.
- C A series of control blocks are allocated to each task.

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## 10 Available Tools

### Dumps

#### SYSUDUMP

Dump of the region and associated control blocks.

This course is going to concentrate on this type of dump which is typically used for application problems.

#### SYSABEND

Dump of the entire system. Typically used for system related problems.

#### Abend-AID

Dump of the problem related areas and an attempt to indicate the problem or the possible problems.

This product is sold by Compuware and provides with a more readable dump, easier to locate the problem components and providing for faster debugging. As a side benefit, it minimizes the amount of paper generated.

SYSUDUMP is the scene of the crime.  
The control blocks are the witnesses.

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## 11 Interactive Debugger

Interactive debuggers permit the programmer to trace through selected portions of the program at execution time.

At selected statements the execution can temporarily halt (breakpoint) and the program can check the values in fields, reset the values, continue execution, insert trace commands or continue execution at another point in the program.

Interactive debuggers include :

- C TESTCOB (VS COBOL)
- C TEST (ALC)
- C COBTEST (VS COBOL II)
- C XPEDITOR
- C INTERTEST (CICS)

12 System Messages

Basic Format

pppnnnns text	ppp - Message Prefix.  nnnn - Number indicating the problem.  s - Type Code.
A	Operator Action Required.
D	Operator must choose an alternative.
E	Operator must perform an action when he/she has time.
I	Informational.
W	Wait, processing stopped until action is performed.

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1           JES2 JOB LOG -- SYSTEM DNCS -- NODE NCSNJE
2
3 ----- JOB 6932 IEF097I B0391810 - USER          AND GROUP          ASSIGNED
4 11.23.07 JOB 6932 IEF677I WARNING MESSAGES(S) FOR JOB B0391810 ISSUED
5 11.23.07 JOB 6932 $HASP373 B039181D STARTED - INIT 7 - CLASS B - SYS DNCS
6 11.23.09 JOB 6932           IEF403I 80391810 - STARTED
7 11.23.50 JOB 6932 IEC141I 013-
8 20.IGG0191A.B039181D.GO.EMPDO.928NSAWO3.B039181.DUMP.DATA1
9 11.23.50 JOB 6932 IEA9951 SYMPTOM DUMP OUTPUT
10          ABEND CODE SYSTEM=013  TIME=11.23.50 SEQ=00449 CPU=0000
11 ASID=002A
12          PSW AT TIME OF ERROR 075C1000  00DA05F6  ILC 2  INTC OD
13          NO ACTIVE MODULE FOUND
14          DATA AT PSW 00DA05F0 - 4100337E6  0A0045E0  378A5820
15          GPR 0-3 00DA0758  A0013000  000066C4  40D9FF72
16          GPR 4-7 008001E8  018D051C  008004D4  018D051C
17          GPR 8-11 008D04F4  0088B07C  00FCC420  00000000
18          GPR 12-15 00000032  00000009  80DA0062  00000020
19          END OF SYMPTOM DUMP
20 11.23.59 JOB 6932 IEF450I 8039181D GO A - ABEND-S013 U0000 REASON=00000000
21 11.23.00 JOB 6932 IEF450I 8039181D - ENDED
22 11.23.01 JOB 6932 $HASP395 8039181D ENDED
    
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