Software Quality Assurance and Testing Lecture - 01

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INTRODUCTION TO SOFTWARE TESTING

What is a computer bug?

- In 1947 Harvard University was operating a room-sized computer called the Mark II.
  - mechanical relays
  - glowing vacuum tubes
  - technicians program the computer by reconfiguring it
  - Technicians had to change the occasional vacuum tube.
- A moth flew into the computer and was zapped by the high voltage when it landed on a relay.
- Hence, the first computer bug!

Bugs a.k.a. …

- Defect
- Fault
- Problem
- Error
- Incident
- Anomaly
- Variance

- Failure
- Inconsistency
- Product Anomaly
- Product Incidence
- Feature :-)

Defective Software

- We develop programs that contain defects
  - How many? What kind?
- Hard to predict the future, however…
  it is highly likely, that the software we (including you!) will develop in the future will not be significantly better.

Sources of Problems

- **Requirements Definition:** Erroneous, incomplete, inconsistent requirements.
- **Design:** Fundamental design flaws in the software.
- **Implementation:** Mistakes in chip fabrication, wiring, programming faults, malicious code.
- **Support Systems:** Poor programming languages, faulty compilers and debuggers, misleading development tools.

Sources of Problems (Cont'd)

- **Inadequate Testing of Software:** Incomplete testing, poor verification, mistakes in debugging.
- **Evolution:** Sloppy redevelopment or maintenance, introduction of new flaws in attempts to fix old flaws, incremental escalation to inordinate complexity.

Adverse Effects of Faulty Software

- **Communications:** Loss or corruption of communication media, non delivery of data.
- **Space Applications:** Lost lives, launch delays.
- **Defense and Warfare:** Misidentification of friend or foe.

Adverse Effects of Faulty Software (Cont'd)

- **Transportation:** Deaths, delays, sudden acceleration, inability to brake.
- **Safety-critical Applications:** Death, injuries.
- **Electric Power:** Death, injuries, power outages, long-term health hazards (radiation).

Adverse Effects of Faulty Software (Cont'd)

- **Money Management:** Fraud, violation of privacy, shutdown of stock exchanges and banks, negative interest rates.
- **Control of Elections:** Wrong results (intentional or non-intentional).
- **Control of Jails:** Technology-aided escape attempts and successes, accidental release of inmates, failures in software controlled locks.
- **Law Enforcement:** False arrests and imprisonments.

Northeast Blackout (August 2003)

It was the worst power system failure in North American history. The failure involved loss of electrical power to **50 million customers, forced shutdown of 100 power plants and economic losses estimated at $6 billion**. The bug was reportedly in one utility company's vendor-supplied power monitoring and management system. The failures occurred when multiple systems trying to **access the same information at once got the equivalent of busy** signals. The software should have given one system precedent. The error was found and corrected after examining **millions of lines of code**.

Definition of Software Testing

Software testing is the process of executing a software system to determine whether it matches its specification and executes in its intended environment.

Software Testing

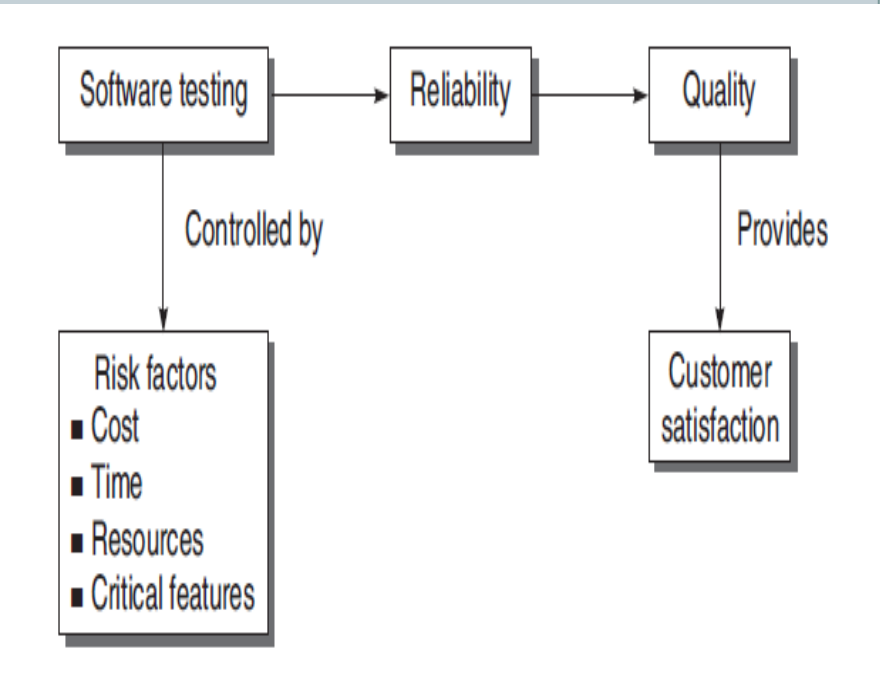
- Testing is the process of executing a program with the intent of finding errors. - Myers [2]
- A successful test is one that uncovers an as-yet-undiscovered error. - Myers [2]
- Testing can show the presence of bugs but never their absence. - W. Dijkstra [125]

SOFTWARE TESTING– MYTHS AND FACTS

- Myth-1: Testing is a single phase in SDLC .
- Myth-2: Testing is easy.
- Myth-3: Software development is worth more than testing.
- Myth-4: Complete testing is possible.
- Myth-5: Testing starts after program development.
- Myth-6: The purpose of testing is to check the functionality of the software
- Myth-7: Anyone can be a tester.

GOALS OF SOFTWARE TESTING

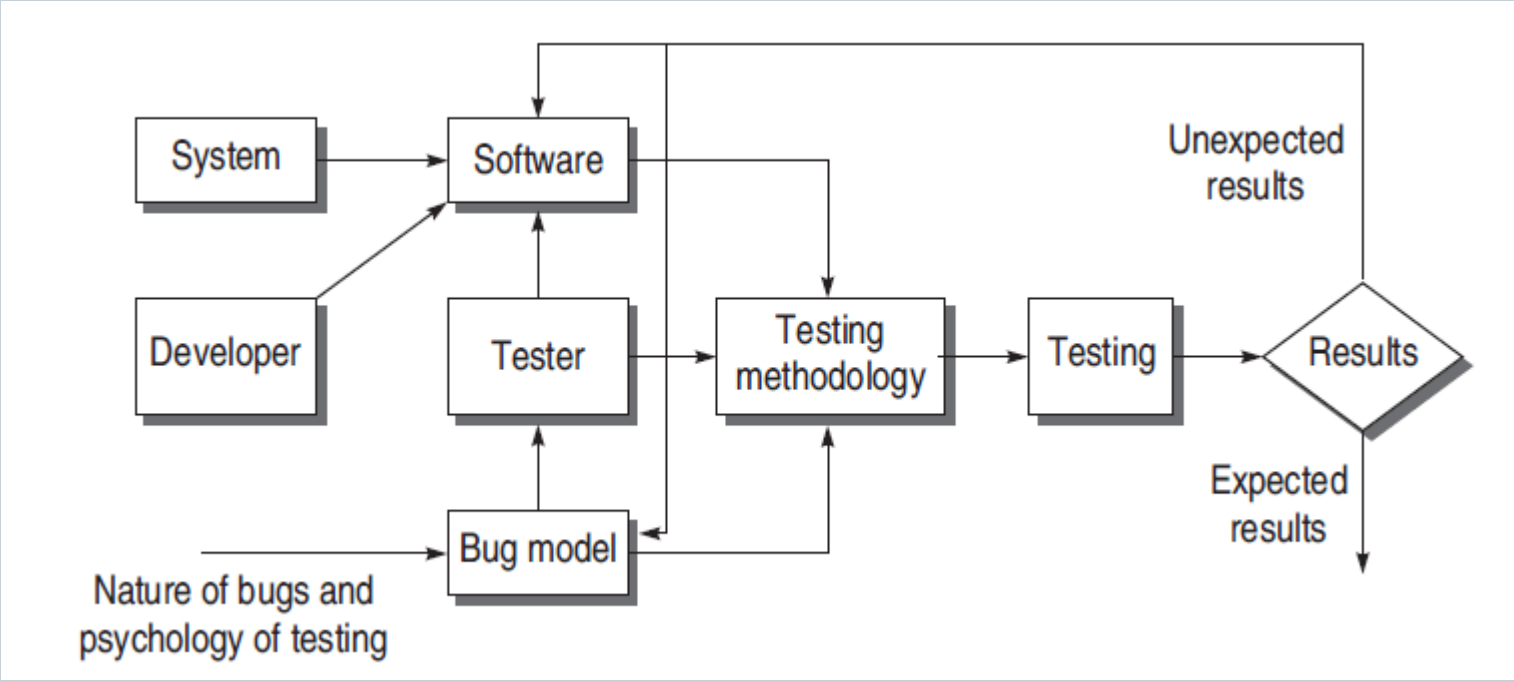
- Short-term or immediate goals
  - Bug discovery
  - Bug prevention
- Long-term goals
  - Quality
  - Customer satisfaction
  - Risk management
- Post-implementation Goals
  - Reduced maintenance cost
  - Improved testing process



PSYCHOLOGY FOR SOFTWARE TESTING

- Testing is the process of demonstrating that there are no errors.
- Testing is the process of executing a program with the intent of finding errors.

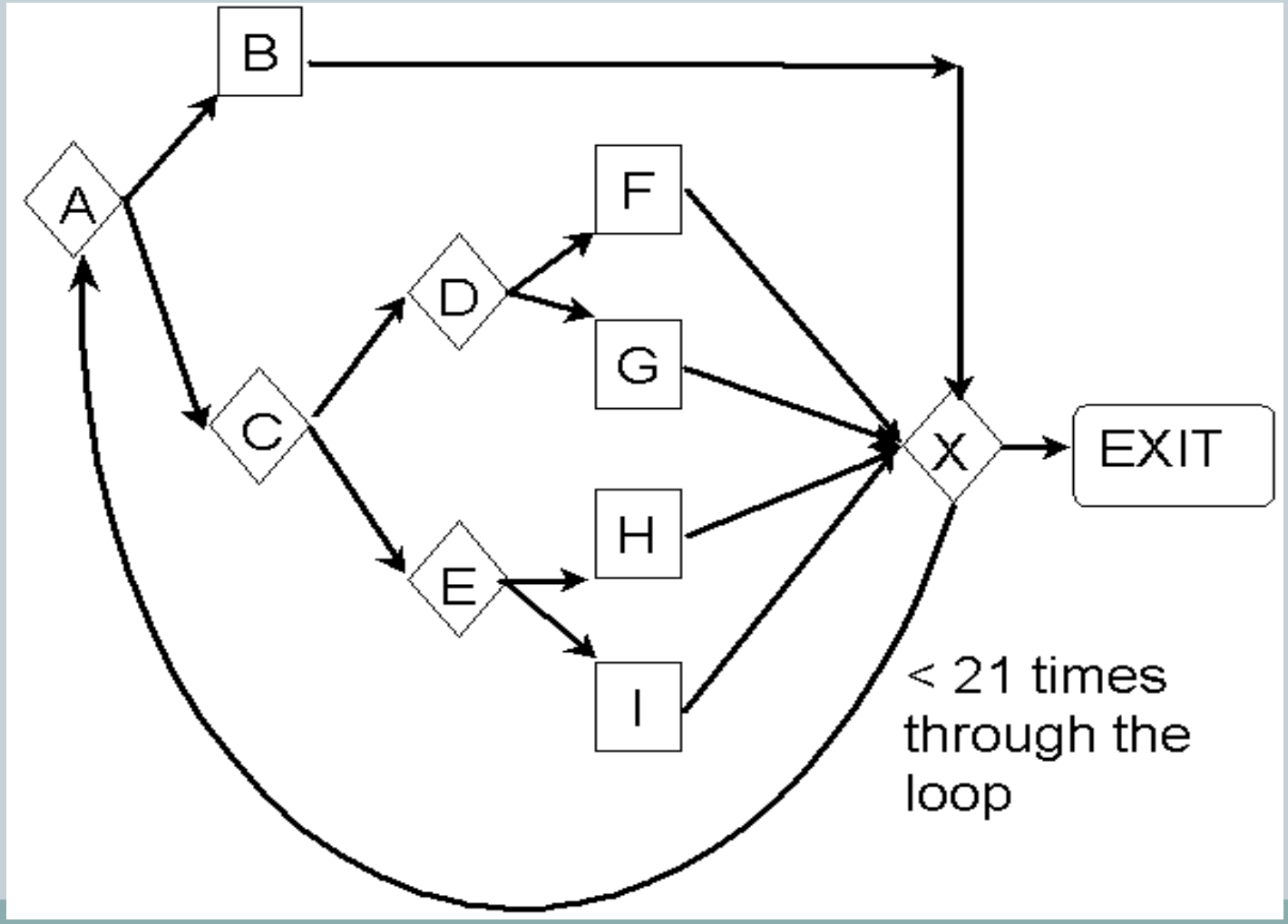
MODEL FOR SOFTWARE TESTING



Why Can't Every Bug be Found?

- Exhaustive software testing is not feasible
  - Too many possible paths.
  - Too many possible inputs.
  - Too many possible user environments.

Too Many Possible Paths

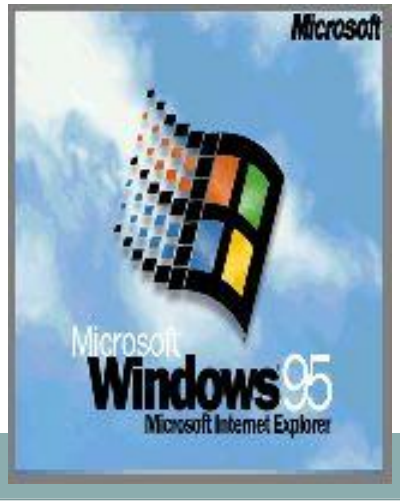


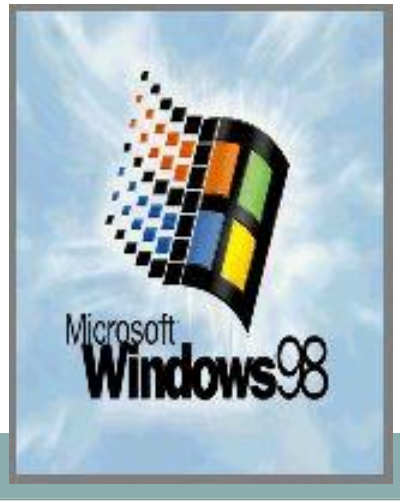
Too Many Possible Inputs

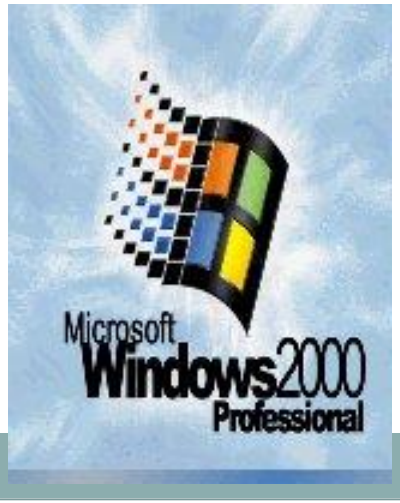
- Programs take input in a variety of ways: mouse, keyboard, and other devices.
- Must test Valid and Invalid inputs.
- Most importantly, there are an infinite amount of sequences of inputs to be tested.

Too Many Possible User Environments

- Difficult to replicate the user's combination of hardware, peripherals, OS, and applications.
- Impossible to replicate a thousand-node network to test networking software.







Thank You

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