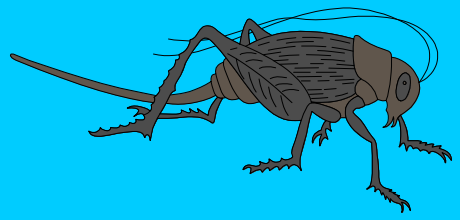
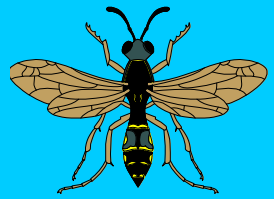
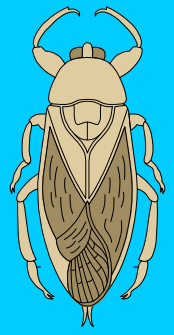
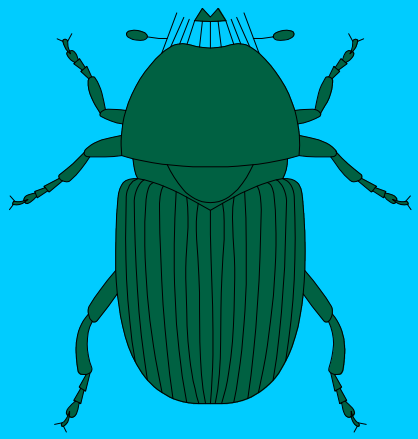
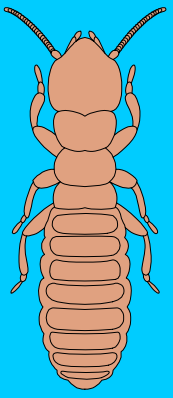
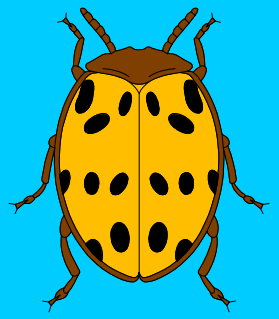


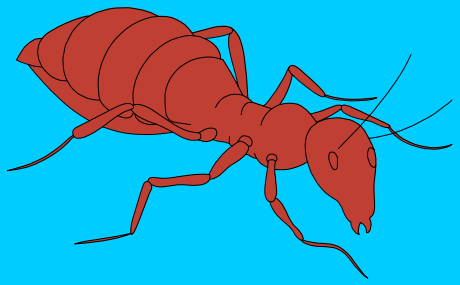












Testing
and
Quality Assurance Techniques

Sandy Sorkin

Coastal Technologies

615 Valley Road - Upper Montclair, NJ 07043

www.coastaltech.com

support@coastaltech.com

A

Socrates went around giving people a lot of good advice.

They poisoned him.

- California 6th grader

Objectives

1. Automate the testing process
2. A structured review process
3. Structured development with reusable code and reusable tests
4. Appropriate progress and performance metrics
5. On-going quality initiatives

Objectives

6. Identify testable conditions
7. Organize testing
8. Teamwork
9. Communications
10. Enjoy your job

Observation - 1

Nothing is obvious

Specifications must be written

Examples

Graphics

Quantify everything

Observation - 2

Do it twice

Test and retest

Design all tests to be repeatable

Test bed should be maintainable

Test initialization & re-initialization

Observation - 3

Everything has a limit

Identify the limits

Test the limits

Language imposed limitations

Platform imposed limitations

Specification imposed limitations

Observation - 4

Design systems with testing in mind

Insert diagnostic tools (instrumentation)

Control totals

Audit trails

Balancing routines

File comparisons

Observation - 5

Practice tact and diplomacy

Don’t be critical all of the time

Offer positive comments

Encourage the right behavior

It is better to find agreement than to win

Observation - 6

The specifications may be wrong

All specifications will change

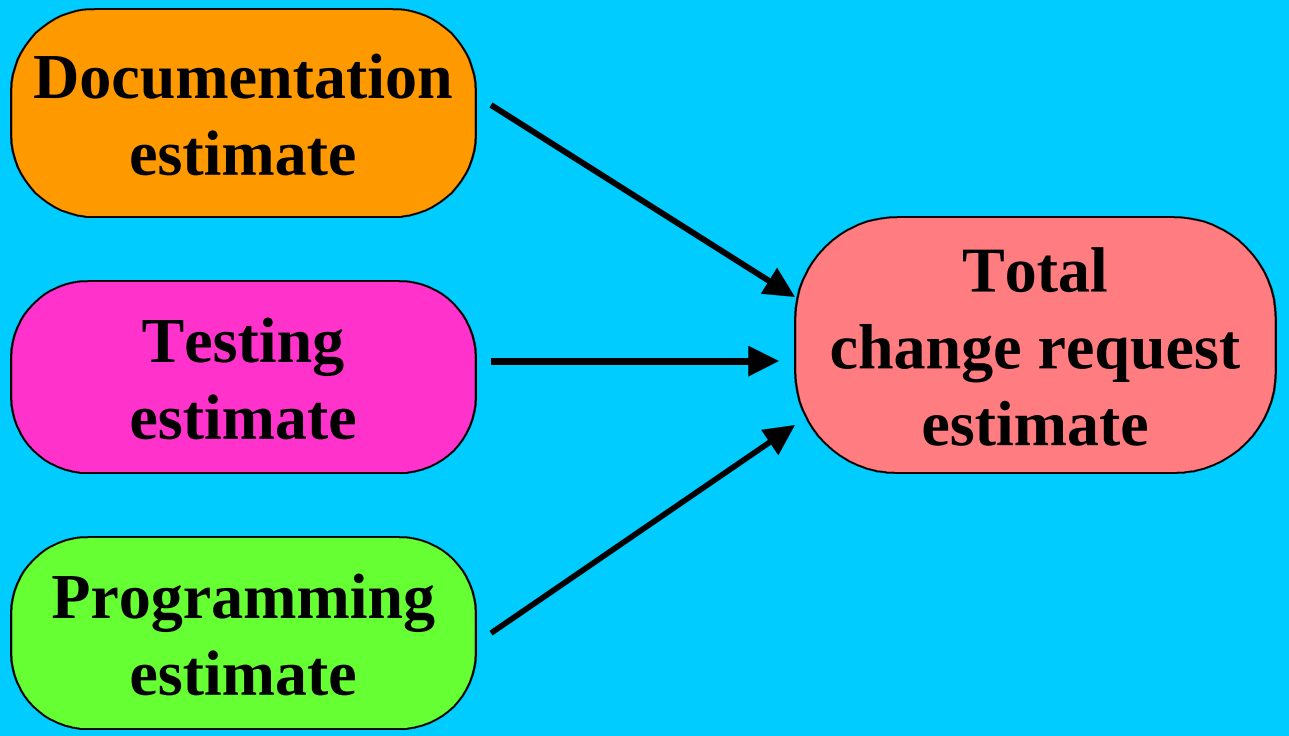
Include test plans in the specs

Identify a formal change process

Don’t fight change

Get better estimates of change impact

Change Requests:
must be in writing and require 3 estimates



First Shopping List

- 1 box cereal
- 2 cans orange juice
- 3 1/2 gallons of milk
- 1 loaf of bread

Shopping List (Spec)

- olives
- laundry detergent
- oatmeal
- juice
- coffee
- dessert for tonight

Shopping List (Spec) Questions

- olives (large, jumbo, can, jar, pimentos)
- laundry detergent (brand, size, aroma)
- oatmeal (instant, flavored, can, box)
- juice (orange, tomato, apple, cranberry)
- coffee (instant, Jamaican, Hawaiian)
- dessert for tonight

Bug Propagation

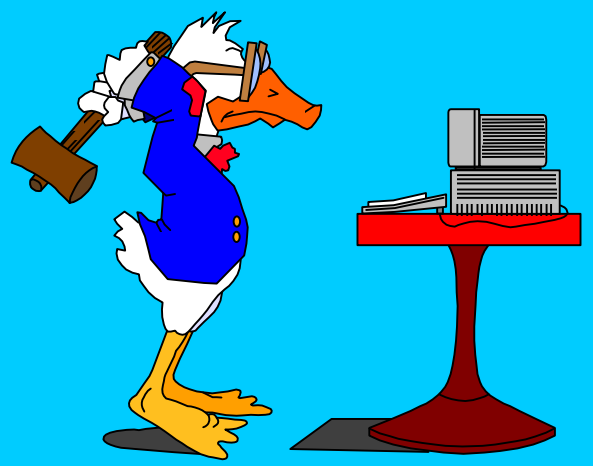
1 bug in analysis

can result in ↓

3-15 bugs in design

can result in ↓

2-10 bugs in code



Worst case: 1 bug in analysis causes 15 bugs in design and they in turn create 10 bugs in the code. Total = 150 code defects. How many will you find in testing?

Impediments

What are the major impediments to quality initiatives in this organization?

1.
2.
3.
4.

Impediments, Opportunities, and Managing

- *No time*

- "We just don't have time to change the way we test or develop systems. Quality improvement is a great idea, but we don't have anyone available right now."

Impediments, Opportunities, and Managing

- *Inertia*

- “Things aren’t so bad, why should I want to do anything differently. No one has yelled at me in over two weeks.”

Impediments, Opportunities, and Managing

- *Need a management buy-in*

- "If management doesn't tell us to improve quality, gives us time, and a budget, nothing is going to happen. Discussing quality with us is simply preaching to the choir."

Impediments, Opportunities, and Managing

- *We're not ready and we need training*

- "We have to get the rest of the shop in order, before we can consider quality improvement suggestions. When will we have time for training?"

Who is responsible for testing?

Customer

They know what they want better than I do.

Business Analysts

They should do all of the testing. They're always talking to the customers.

Programmers

If they do their job properly, no one else has to test.

Quality Assurance

Its their job.

Quality Questions

1. What is quality.
2. What does it cost?
3. How is quality measured?
4. Where does quality come from?

Quality Improvement Suggestions: 1

Joint Application Design sessions (JAD/JAR)

Define business objectives

Insist on written specifications

Use prototyping tools

Write user manuals (before coding)

Estimate the testing effort

Allocate resources to automate testing

Quality Improvement Suggestions: 2

Instrumentation

Written unit test plans (before coding)

Enforce development methodologies

Enforce coding standards

Earlier involvement of QA personnel

Capture and report metrics

More documentation

Quality Improvement Suggestions: 3

Risk and Contingency analysis

Follow-up process for suggestions

Reusable tests

Maintainable test beds

Walkthroughs

Earlier Reviews

Written unit test plans

Concise Project Management Course

- **Milestones**
  - **40 hour rule**
  - **80 hour rule**
- **Deliverables**
  - **Measurable**
  - **Reviewable**
  - **Achievable**
- **Document everything**
- **Review everything promptly**

	Front End	Coding	Back End
Traditional	35%	15%	50%
Quality Process	42%	18%	28%

12% productivity increase

50+% fewer defects

12-15% faster to market

It may cost less to leave the defects out of the system, than to pay to put them in, pay to find them, and then pay to take them out again.

Reliability Metrics

Mean Time Between Failures

- $MTBF_1$ Crash, software inoperable
- $MTBF_2$ Functional failure
- $MTBF_3$ Quality failure
- $MTBF_4$ Client Server failure

Reliability Metrics

Mean Time To Repair

- $MTTR_1$ Actual time to fix
- $MTTR_2$ Total time in queue

Test Scripts (Generic Tests)

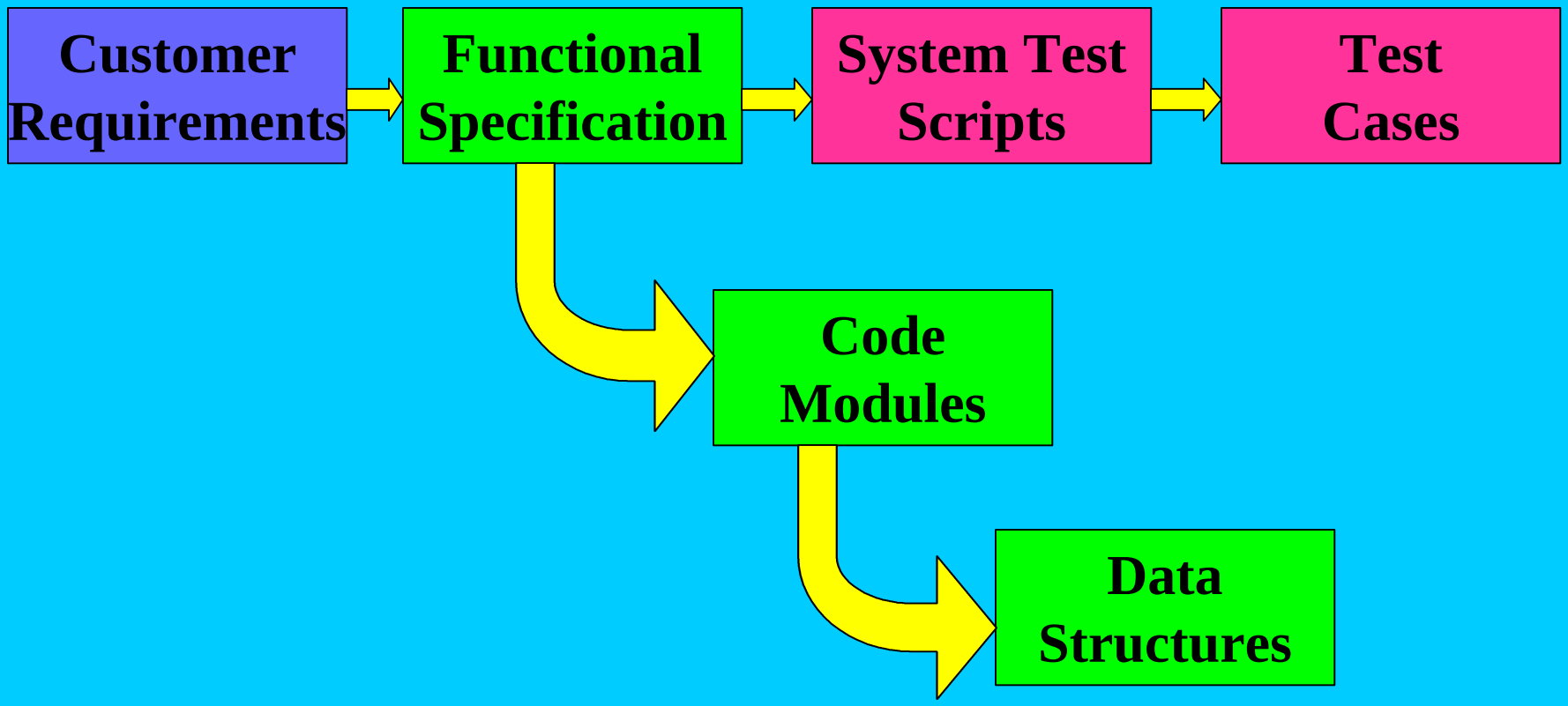
- Unit Test Scripts
  - Component level tests
- System and Acceptance Test Scripts
  - Functional tests
  - Test threads
  - End-to-end tests
  - Start-to-finish

No time to perform a regression test?

Alternatives

- Parallel testing
- Volume testing with live data
- Volume testing with test data
- Local, regional, expanded regional testing
- Statistical sampling
- Testing changes only
- Combine sample data with known problems

Traceability Matrix



Black Box Testing

Specification:

C = (A*B)

A: Integer, 1 to 100

B: Integer, -5 to +5

Dynamic Testing

Validation

Test Plan

Inputs		Expected Result
A	**B**	**C**
1	1	1
1	6	Error
5	5	25

White Box Testing

Specification:

C = (A*B)

A: Integer, 1 to 100

B: Integer, -5 to +5

Static Testing

Verification

Code Example 1:

```
Move 0 to A, B
GetInput(A,1,100,B,-5,5)
Compute C = A*B
Compute Tot = Tot + C
Print C
```

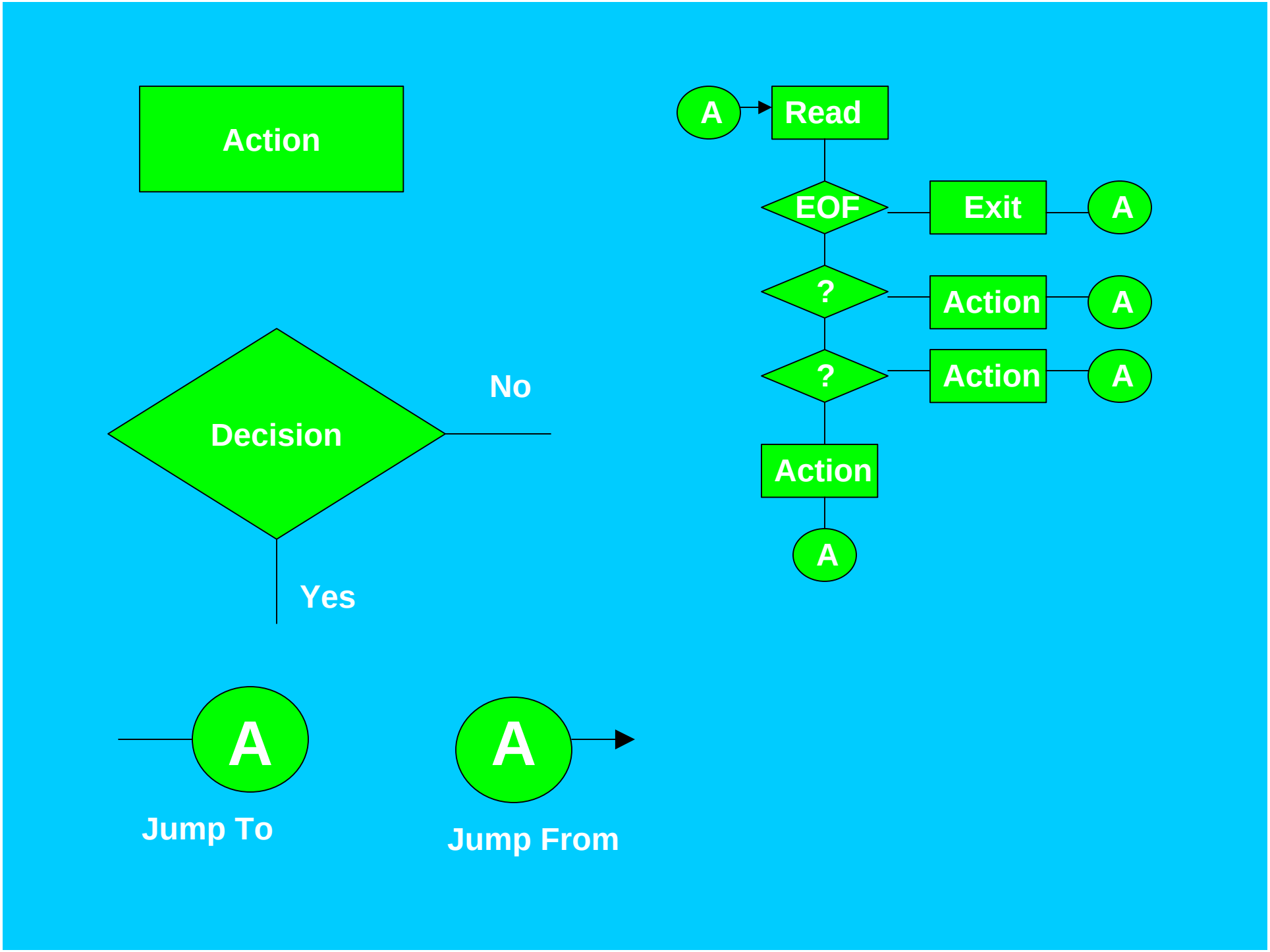
Code Example 2:

```
Move 0 to A, B
GetInput(A,0,100,B,-5,5)
Compute C = A * B + .000001
Compute Tot = Tot + C
```

Quotes

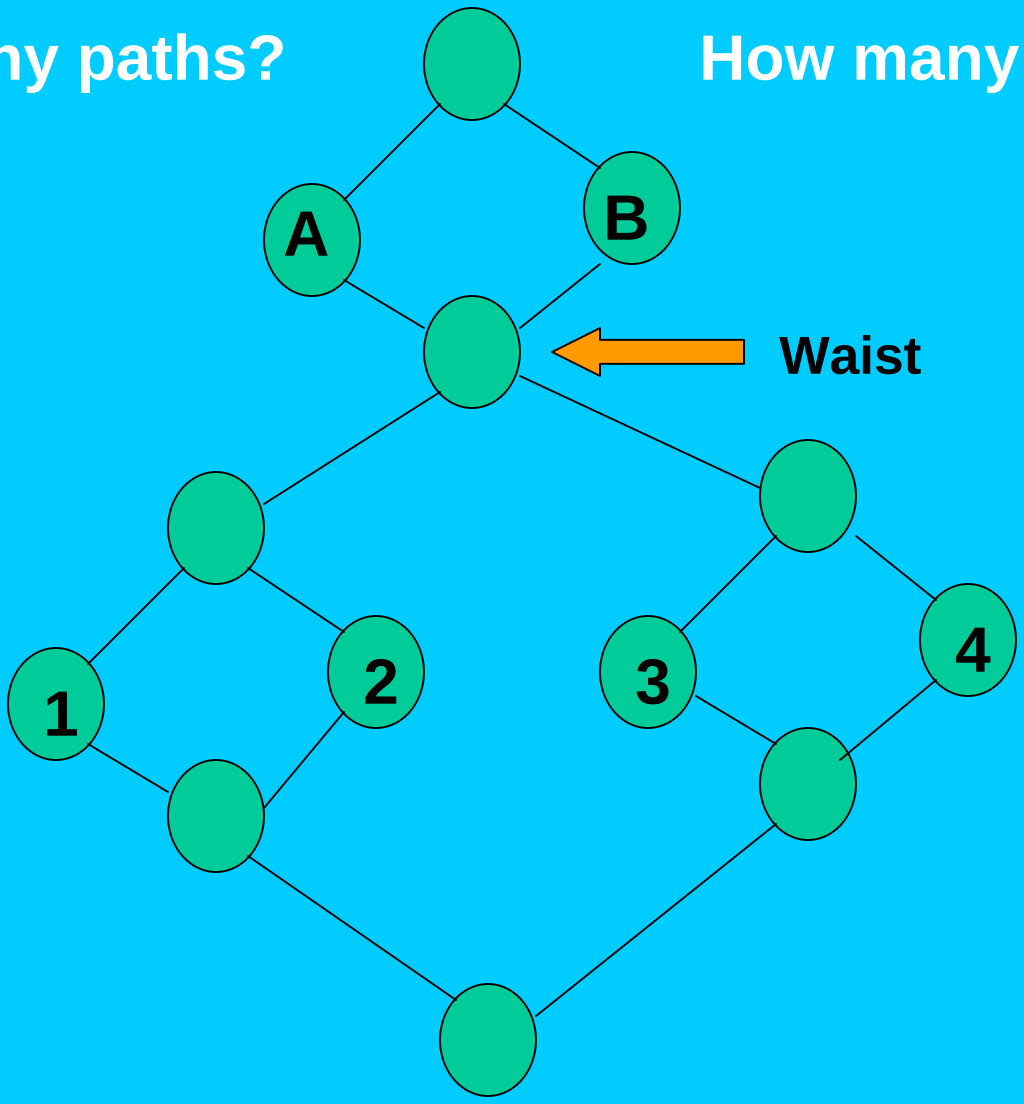
- It compiled, it’s got to be good.
- It usually works.
- No reasonable customer would ever do that.
- Trust me, it’s okay.

- It worked yesterday.
- It works on my machine.
- I tested it for you.
- Of course it doesn’t pass that test.
- What could go wrong?


Action
A
Read
EOF
Exit
A
?
Action
A
?
Action
A
Action
A
Decision
No
Yes
A
Jump To
A
Jump From

How many paths?

How many test cases?



Binary

Decimal	Binary	
0	0000	nnnn
1	0001	nnny
2	0010	nnyn
3	0011	nnyy
4	0100	nynn
5	0101	nyny
6	0110	nyyn
7	0111	nyyy
8	1000	ynnn
9	1001	ynny
10	1010	ynyn
11	1011	ynyy
12	1100	yynn
13	1101	yyny
14	1110	yyyn
15	1111	yyyy

Screen Edits

- Screen defaults
- Function keys
- Escape key
- Minimize screen
- Maximize screen
- Drag screen
- resize screen
- Initial screen size
- Initial screen location
- O/S Characteristics
- Resolution
- Color
- Fonts
- Menu bars
- Button bars
- Navigation bars
- Slide bars
- Screen title

Button Edits

- Single click
- Double click
- Look & feel
- Space bar
- Tab
- Enter
- Hot key
- Other events that can be triggered
- Escape
- Default setting
- Color
- Relational edits
- Focus box

Character Entry

- Leading spaces
- Trailing spaces
- Embedded spaces (multiples)
- Permitted spaces
- Special characters (numeric, CTRL, ALT, SHIFT, foreign)
- Specific valid or invalid characters
- Font
- Color
- Case sensitivity
- Entry templates
- Minimum field length
- Maximum field length

Recommendation Guidelines

1. **All recommendations must be written.**
   Verbal doesn't count.

2. **Provide a means to measure the results.**
   Results that can not be predicted, or quantified, make the suggestion seem less credible.

3. **Offer a brief assessment of the current situation.**

4. **Keep it short.**
   Try to get everything on one page.

Root Cause Analysis

- **When was the error made?**
- **Who made the error?**
- **What was done incorrectly?**
- **How could the error have been prevented?**
- **Why wasn’t the error detected earlier?**
- **How could the error have been detected earlier?**
- **How was the error found now?**
- **Has this happened before?**
- **Is the problem in any other systems?**

Question

Which best describes your job?

1. Defect detection

2. Defect prevention

Assessing Readiness to Automate

1. **Are good testing policies and procedures in place today?**
2. **Is there time to learn how to use the automated testing tool?**
3. **Will there be ongoing training?**
4. **Are the development team and test team in agreement about the use of automated test tools and procedures?**
5. **Are you ready to make a total commitment to the testing tool?**

Assessing Readiness to Automate

6. **Are your development language and platform supported?**
7. **How many platforms will you test?**
8. **Are you testing embedded systems?**
9. **Is the budget adequate?**
10. **How much support will your organization require?**

1. **Design all tests to be repeatable**

2. **Design the test bed to be maintainable**

Question

Which activity will enable you to make the greatest contribution to your organization?

1. Running tests

2. Identifying testable conditions