CS 216

Lecture 1

January 17th, 2014

CS 216 Introduction to Software Engineering

Logistics

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35% - Programming
30% - Weekly Assignments
25% - Tests
    10% - Midterm
    15% - Final
10% - Attendance

Typical week:

Practicum assignment due Thursday at midnight.

Homework due Friday at midnight.

Programming assignments due on Sunday nights, with extra office hours that week.

Clicker quizzes for attendance can happen any lecture


Avenue of Champions
Lexington Ave
Joe Craft Center
Memorial Coliseum
Stoll Field
Rose St
Linden Walk
Rose Ln
F. Paul Anderson Tower
Center for Robotics and Manufacturing Systems
ASTECC Building
McVey Hall
1974
27

Homework!
Combined with the first lab next week; due 1/24.

multilab

nethack

source control

CS 216 has three basic foci:

C++ programming in more depth (and object oriented design, too)

Software engineering techniques

Unix/Linux environment

Why?

Why?

The first skill of an engineer is asking questions.

Active participants

So,
programming.

Programming languages are notations.

We express ideas with them

$$f(x) = x^2$$

```
(defun f (x)
  (* x x))
```

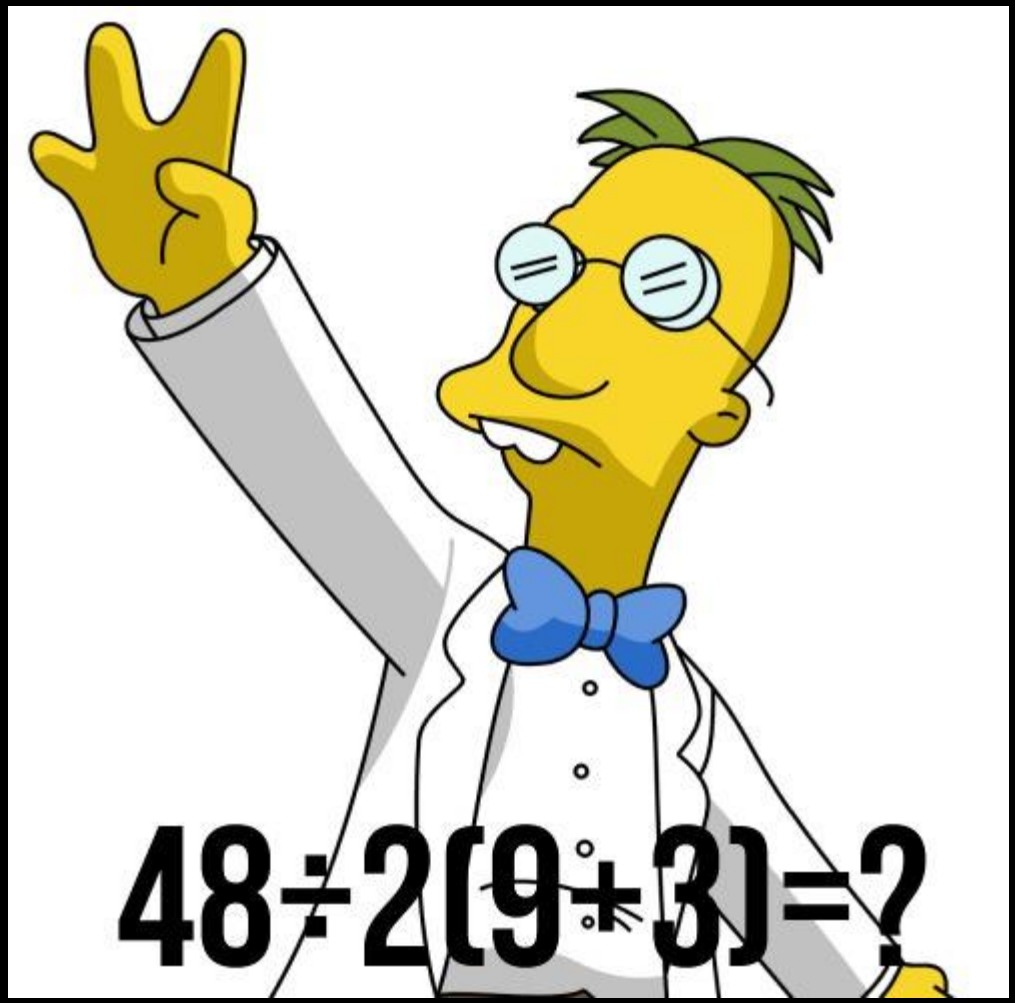
```
Declare:
    F(Domain) : Range

Satisfying:
    ! x [Domain] : F(x) = (x * x).
```

```
double f(double x)
{
    return x * x;
}
```

```
template<class T>
T f(T x)
{
    return x * x;
}
```

What ends up being critical is the clarity of expression of those ideas!


48÷2(9+3)=?

Stop wasting everyone's time and use more parentheses.

“Buffalo buffalo, Buffalo buffalo buffalo Buffalo buffalo.”

What is engineering?

en·gi·neer·ing *noun* \-'nir-iŋ\

Definition of ENGINEERING

1 : the activities or function of an engineer

2 **a** : the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people

b : the design and manufacture of complex products <software *engineering*>

3 : calculated manipulation or direction (as of behavior) <social *engineering*> — compare GENETIC ENGINEERING

See engineering defined for English-language learners »
See engineering defined for kids »

Examples of ENGINEERING

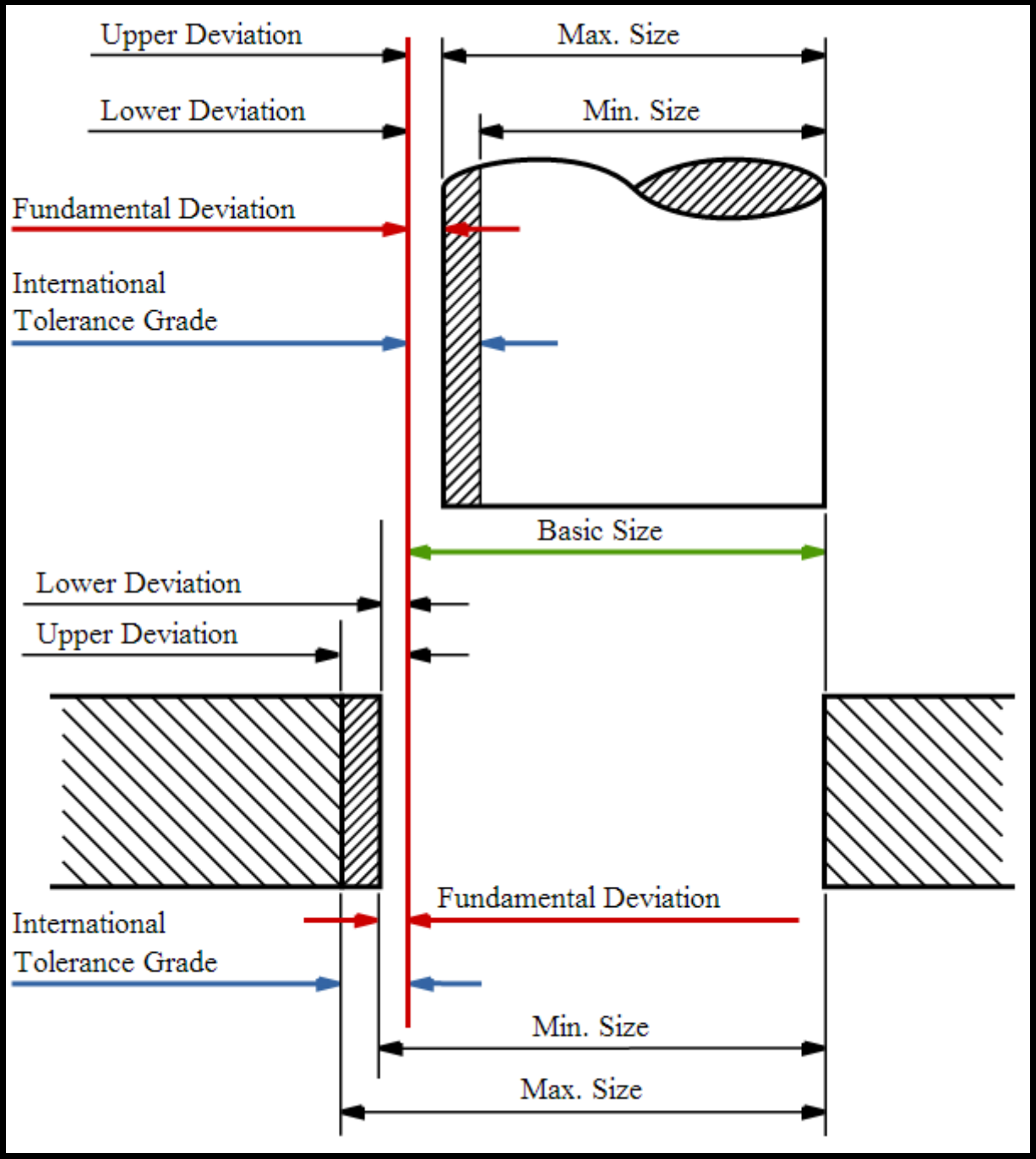
Rhymes with ENGINEERING

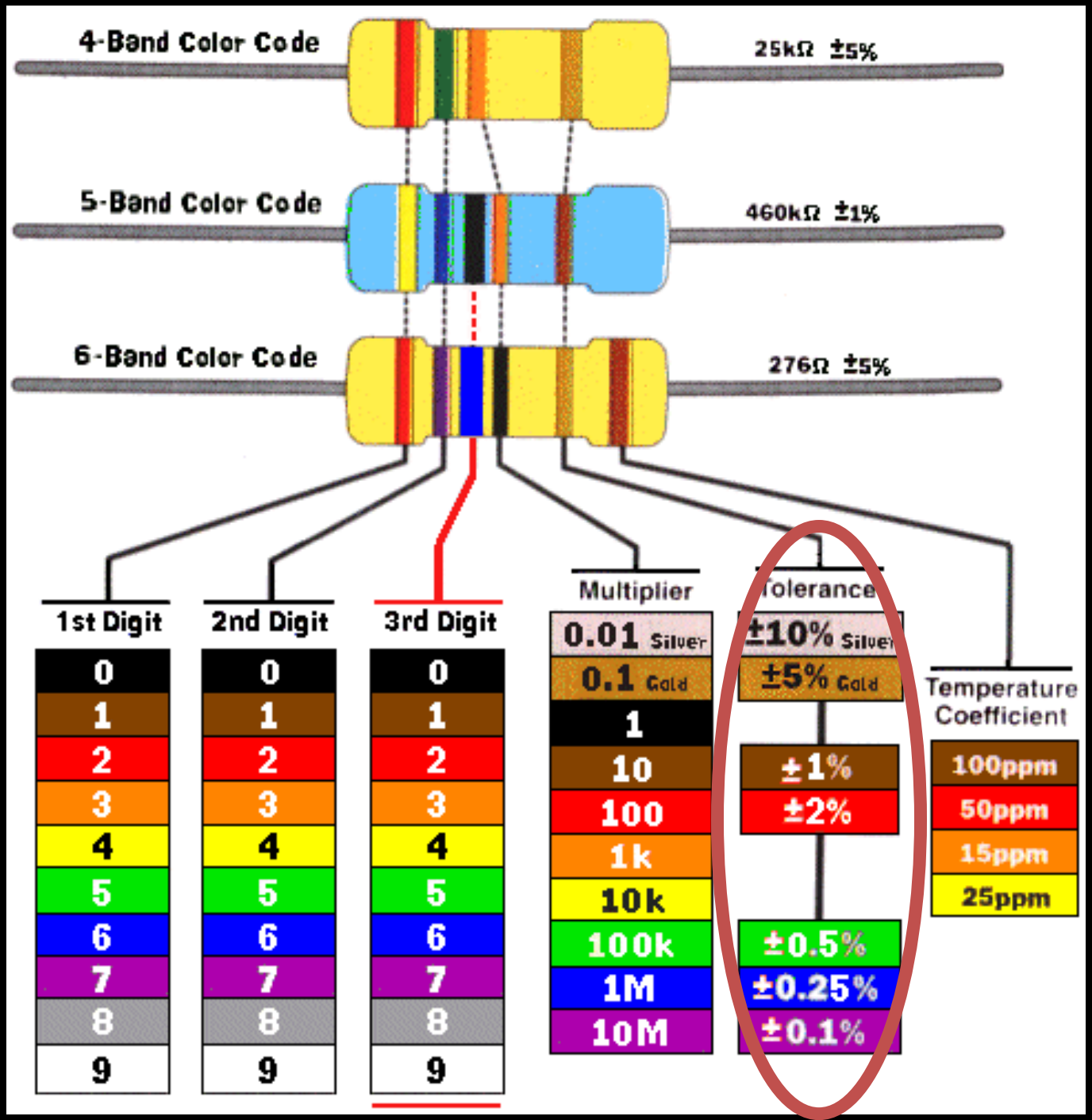
fictioneering, mountaineering, power steering

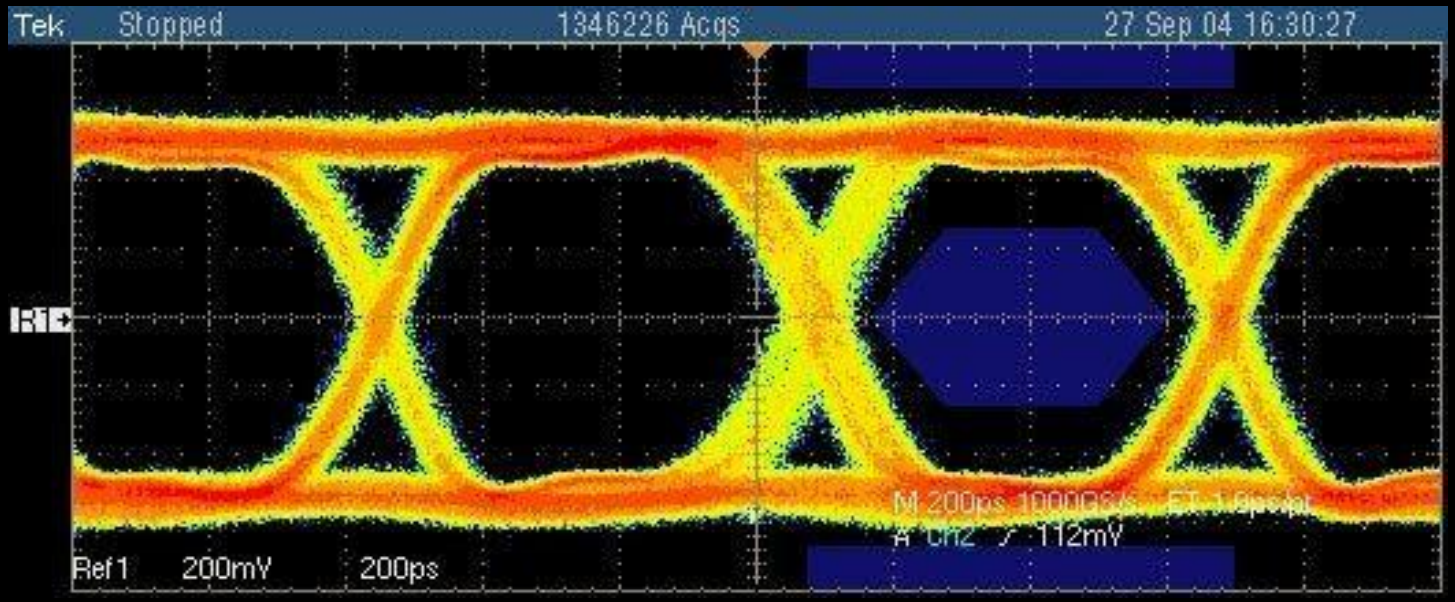
Design

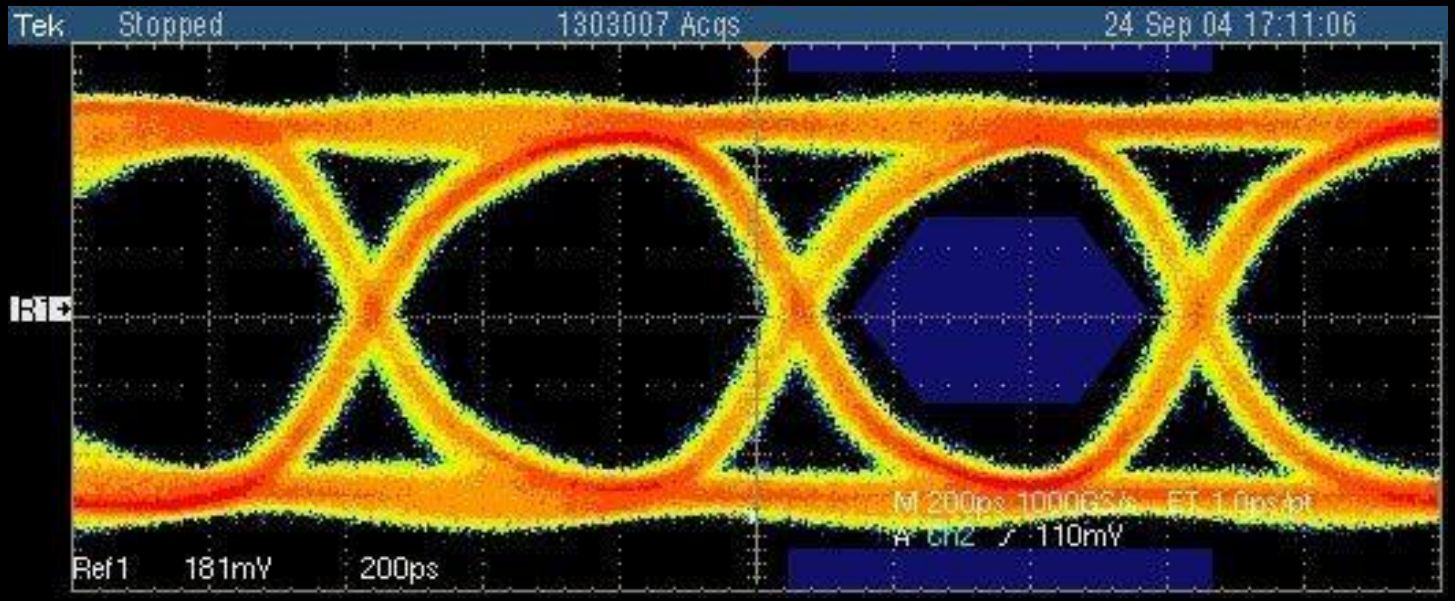
Constraint

Imperfection


Upper Deviation
Max. Size
Lower Deviation
Min. Size
Fundamental Deviation
International
Tolerance Grade
Basic Size
Lower Deviation
Upper Deviation
Fundamental Deviation
International
Tolerance Grade
Min. Size
Max. Size


4-Band Color Code
25kΩ ±5%
5-Band Color Code
460kΩ ±1%
6-Band Color Code
276Ω ±5%
1st Digit
2nd Digit
3rd Digit
Multiplier
Tolerance
Temperature Coefficient
0
1
2
3
4
5
6
7
8
9
0.01 Silver
0.1 Gold
1
10
100
1k
10k
100k
1M
10M
±10% Silver
±5% Gold
±1%
±2%
±0.5%
±0.25%
±0.1%
100ppm
50ppm
15ppm
25ppm


Tek Stopped 1346226 Acqs 27 Sep 04 16:30:27
M 200ps 10000GS/s ET 1.0ps/pt
A Ch2 ∕ 112mV
Ref1 200mV 200ps

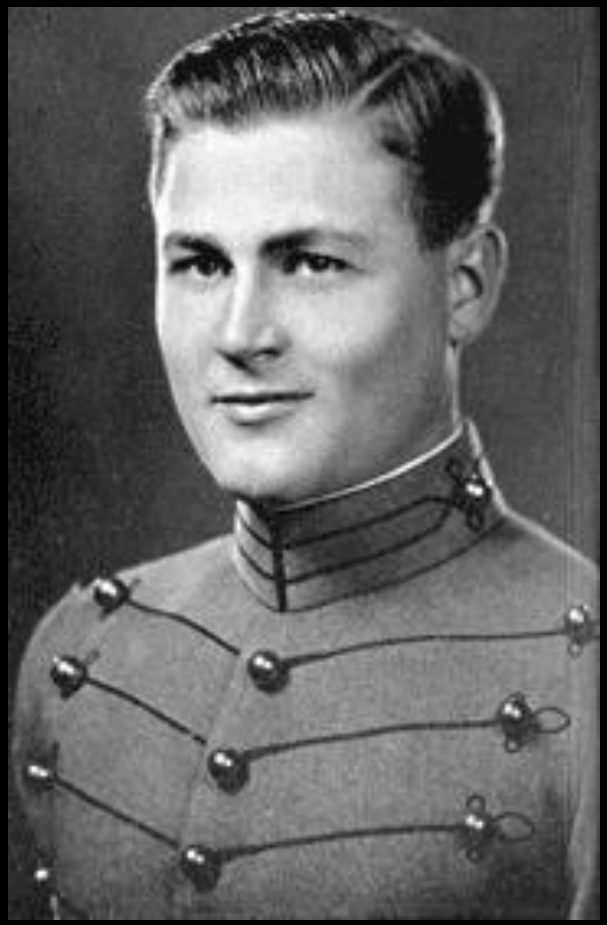

Tek Stopped 1303007 Acqs 24 Sep 04 17:11:06
M 200ps 10000GS/s ET 1.0ps/pt
A Ch2 ∕ 110mV
Ref1 181mV 200ps

I don’t really like to say engineering is largely about failure…

But engineering is largely about failure.

Failure is a common consequence of the interaction between constraint and imperfection.

This is magnified by scale!



Edward Aloysius Murphy, Jr

“Anything that can go wrong, will.”

“If there is any way to do it wrong, he will.”

“If it can be done wrong, then somebody is going to do it wrong.”

Let's apply this to software

Concurrency & Networking

Our most important imperfection is ourselves.

We want software that contains no mistakes.

However – we understand that not making mistakes is not a viable option.

“Writing it perfect the first time” is just not feasible from a cost perspective.

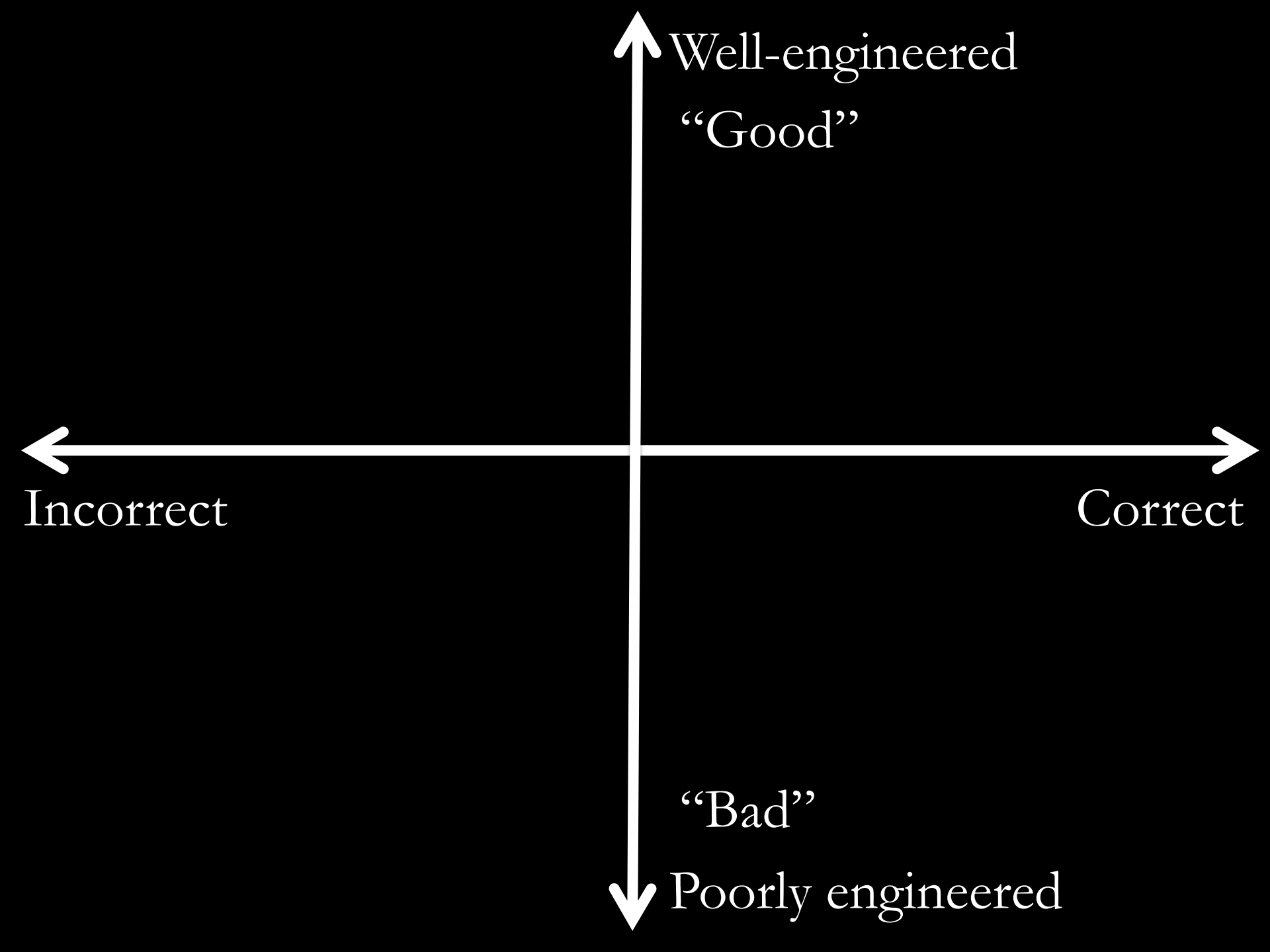
So what do we do?

Anticipate mistakes

Detect mistakes

Fix mistakes

This is software engineering


Well-engineered
"Good"
Incorrect
Correct
"Bad"
Poorly engineered

Why is this so important if it works?

Code is like diamond.

CHAOS Report

Successful: Finished on time and on budget.

Challenged: Completed, but over budget, late, etc.

Table I

Standish project benchmarks over the years

Year	Successful (%)	Challenged (%)	Failed (%)
1994	16	53	31
1996	27	33	40
1998	26	46	28
2000	28	49	23
2004	29	53	18
2006	35	46	19
2009	32	44	24

But what does “success” really mean?

Software projects are never really “done”

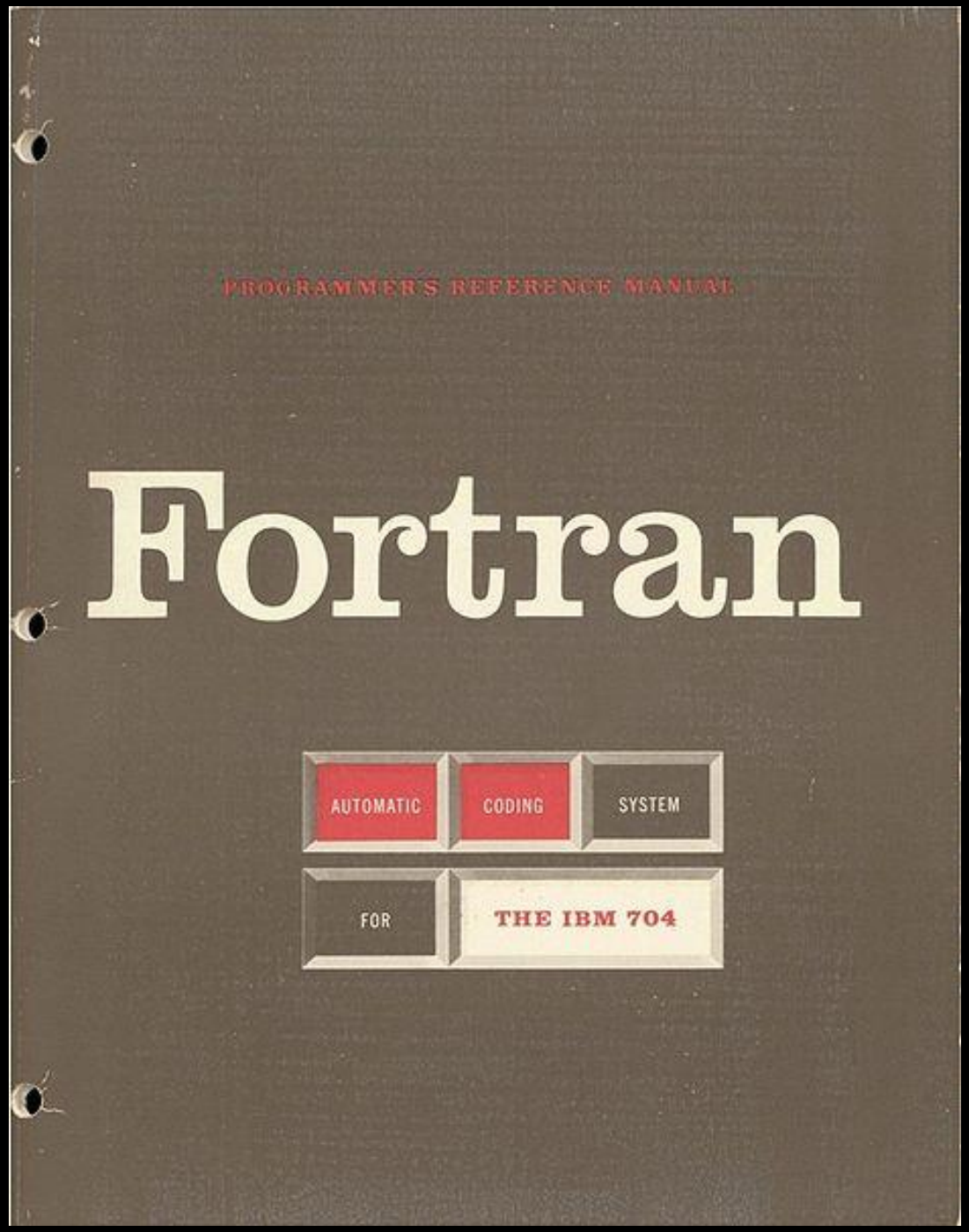
There's a transition from active development to maintenance

And maintenance can be over 90% of the time spent on the project!

So how did we get here?

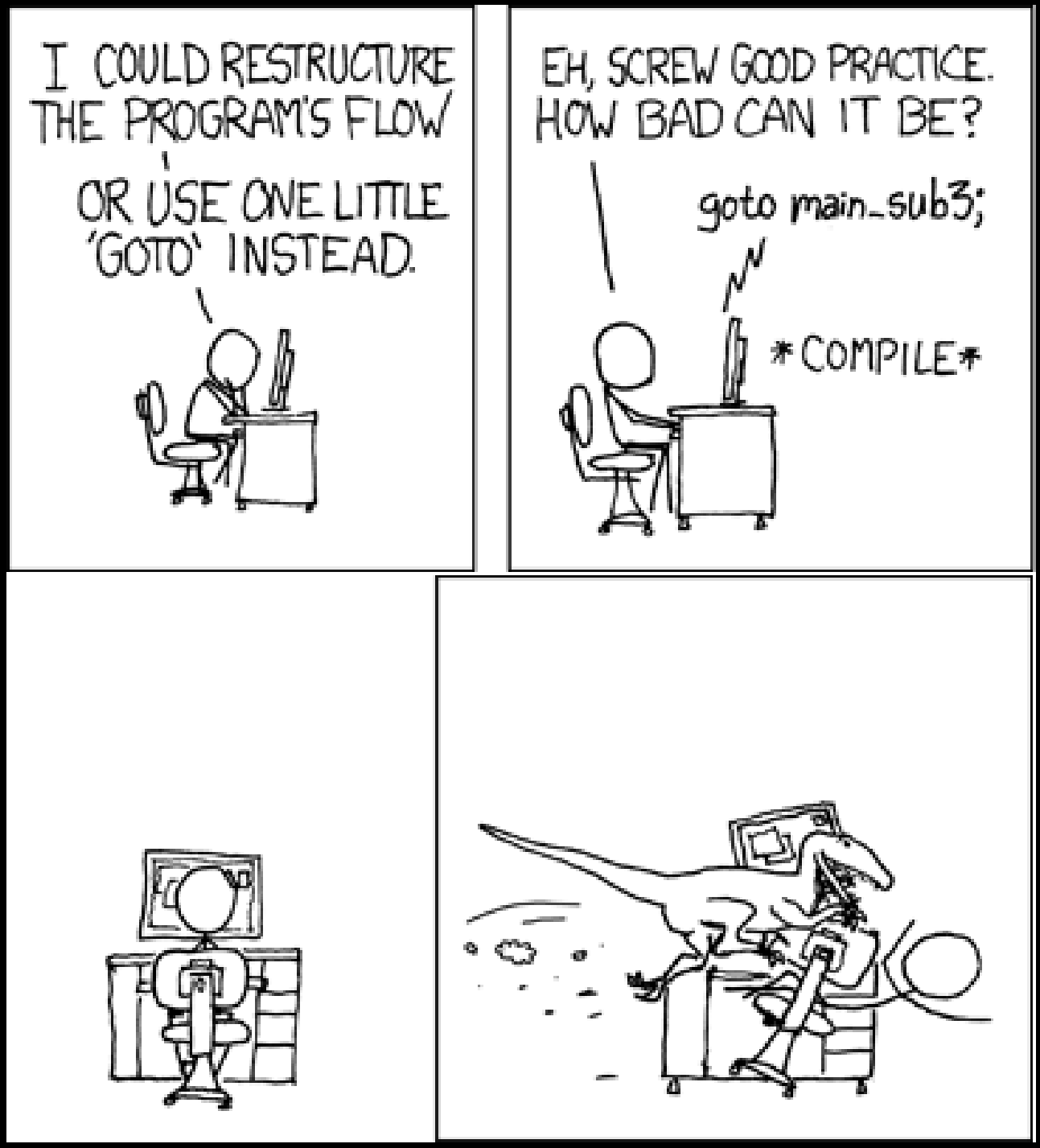

Zuse Z4 - 1945


IBM 704 - 1954


PROGRAMMER'S REFERENCE MANUAL
Fortran
AUTOMATIC
CODING
SYSTEM
FOR
THE IBM 704

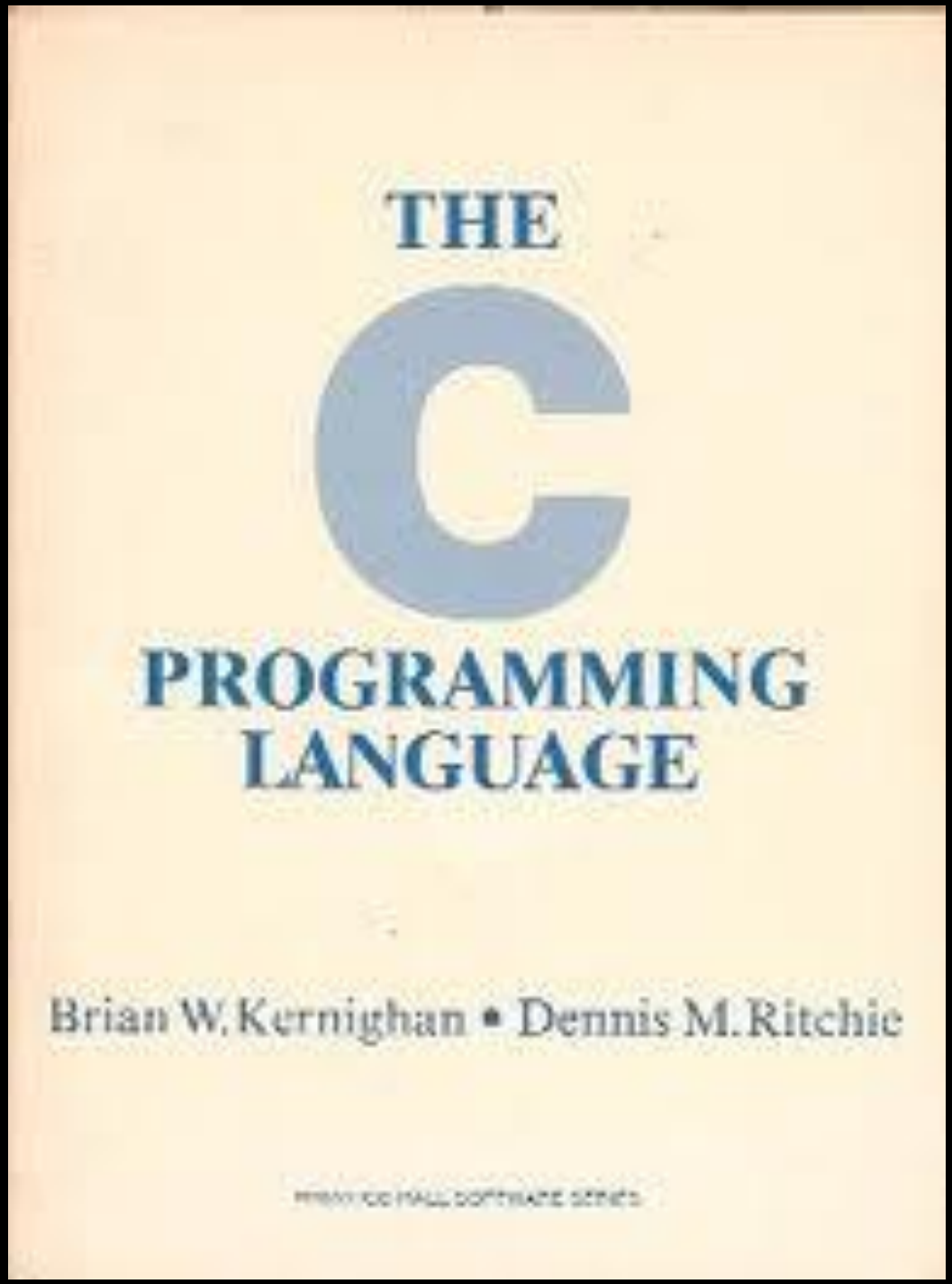
1956

1968
Go To Statement Considered Harmful


I COULD RESTRUCTURE THE PROGRAM'S FLOW
OR USE ONE LITTLE 'GOTO' INSTEAD.
EH, SCREW GOOD PRACTICE. HOW BAD CAN IT BE?
goto main_sub3;
COMPILE

1969

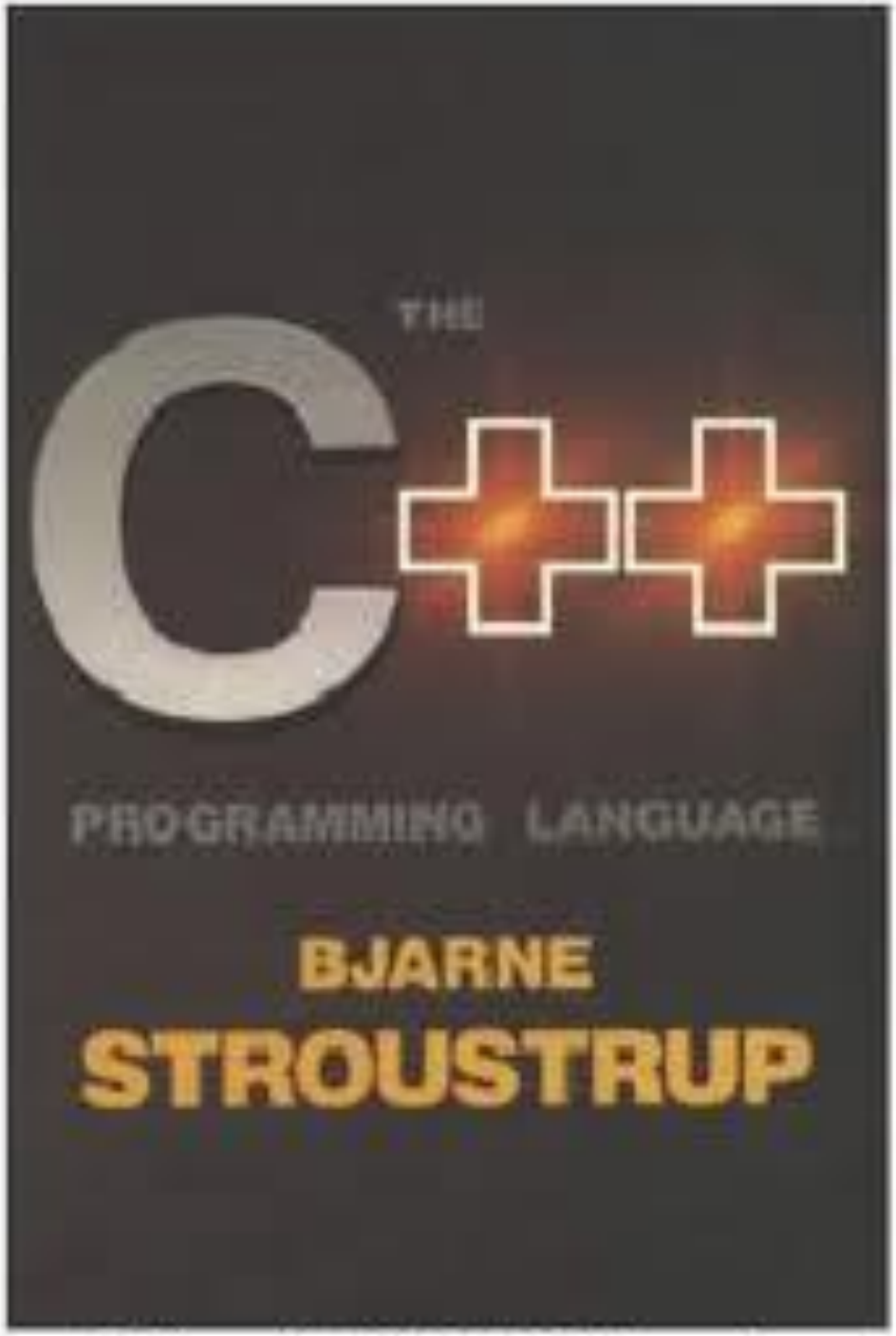
PDP11- 1970


THE
C
PROGRAMMING
LANGUAGE
Brian W. Kernighan • Dennis M. Ritchie

1972

IBM PC - 1981


Introducing the same old idea.
YUGO, $3990.*



1982

I think C++ is a great teaching language.

This doesn't mean it's perfect.

```
a = b;
```

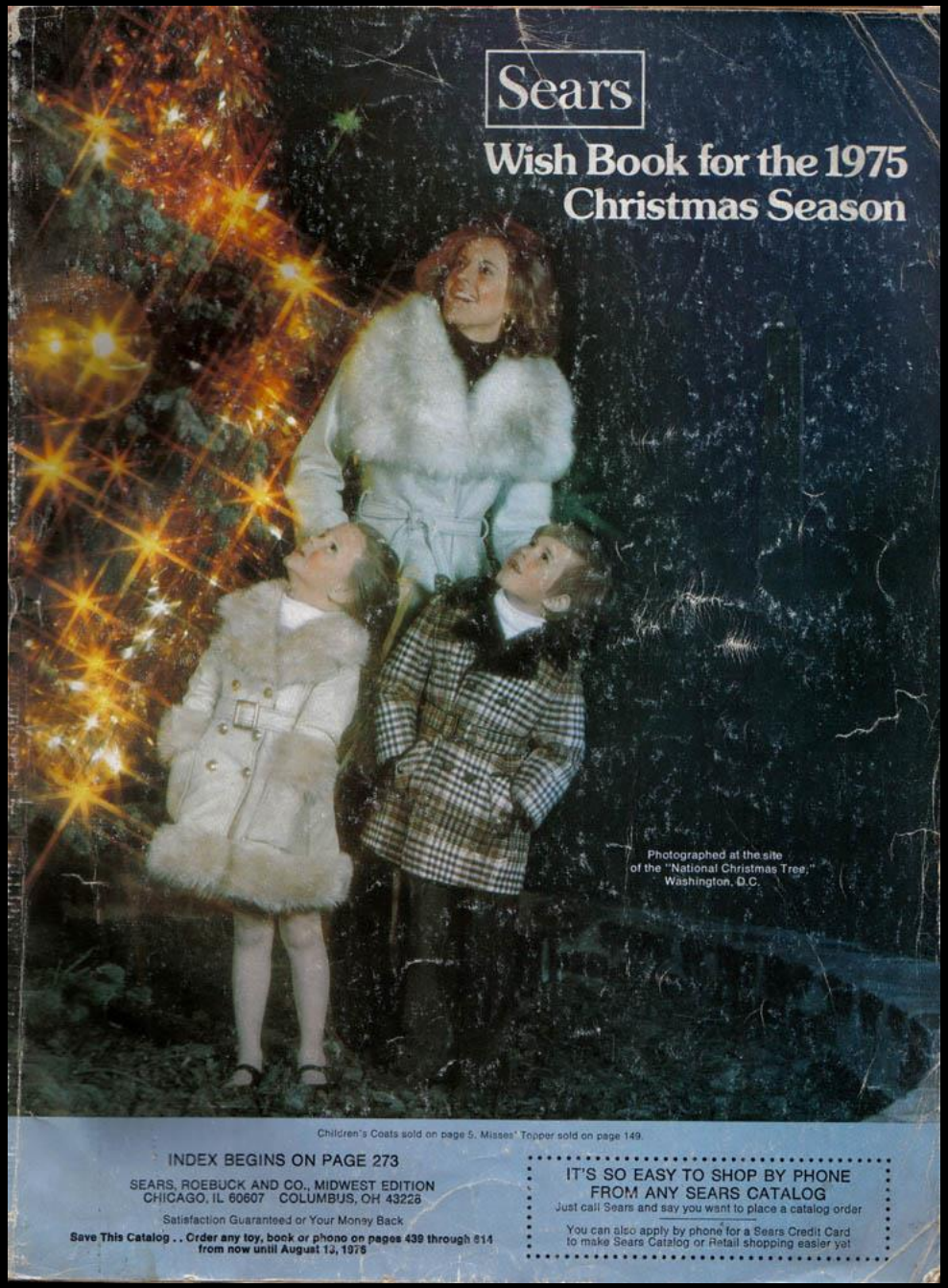
```
a == b;
```

C++ – by design – is *basically* a superset of C.

FORTRAN: 1956

C: 1972

1972-1956 = 16



Children's Coats sold on page 5. Misses' Topper sold on page 149.

INDEX BEGINS ON PAGE 273

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Men's neck sizes XS(13½ in.); S(14–14½); M(15–15½); L(16–16½); XL(17–17½). **State letter size** XS, S, M, L or XL, *not number size.*

Women's bust sizes XS(31–34½ in.); S(35–39½); M(40–42); L(42½–44). **State letter size** XS, S, M or L, *not number size.*

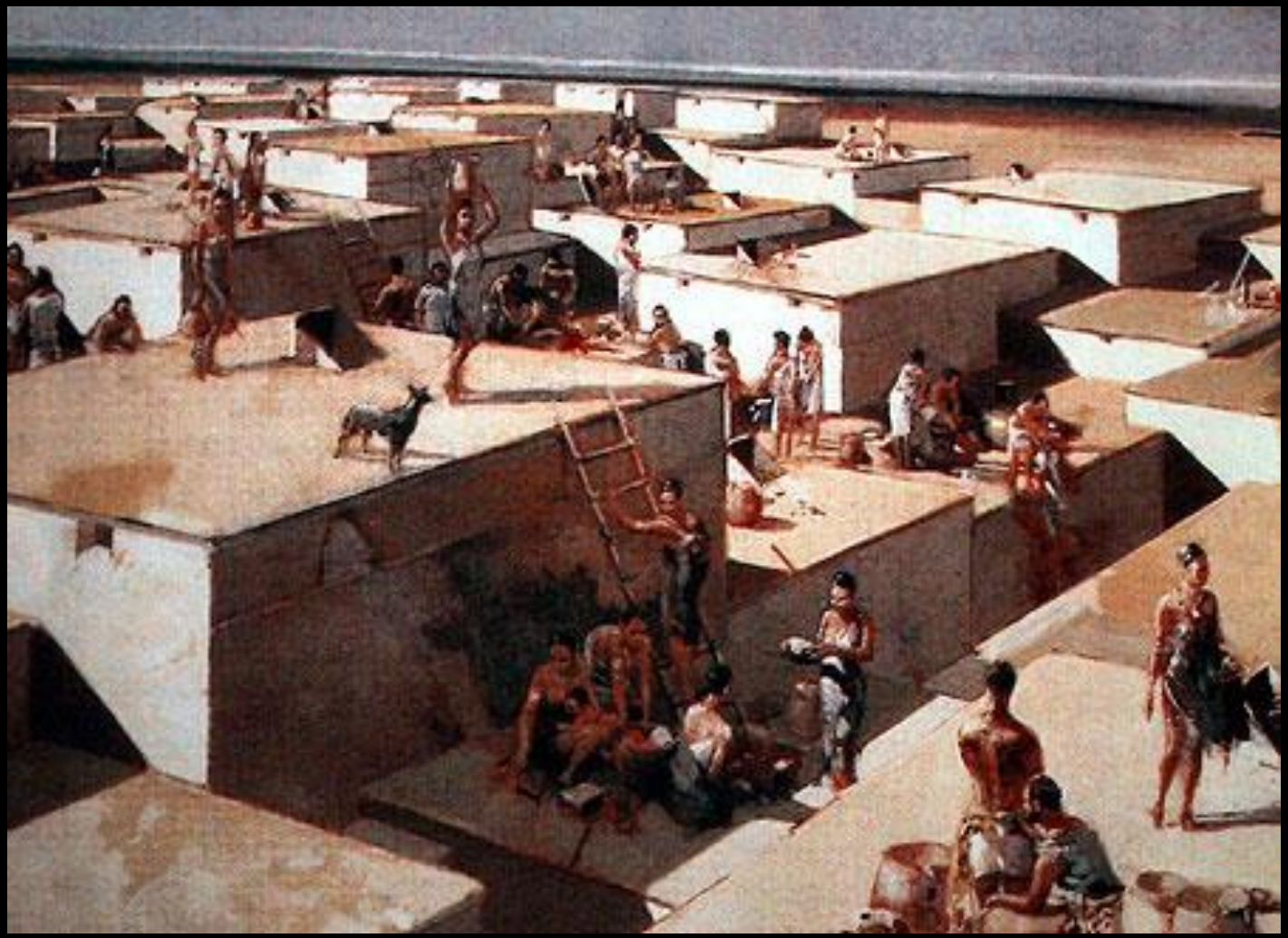
1 **Multicolored embroidered highlights.** Natural ecru shade body with both front and back yoke embroidered in a multicolored pattern. 51 C 50801F—*See sizes for men and women above.* Shpg. wt. 12 oz. $9.97

2 **Solid green highlights.** Navy and green floral design body with coordinating solid green front and back yokes, collar, pocket flaps and cuffs. 51 C 50804F—*See sizes for men and women above.* Shpg. wt. 12 oz. $9.97

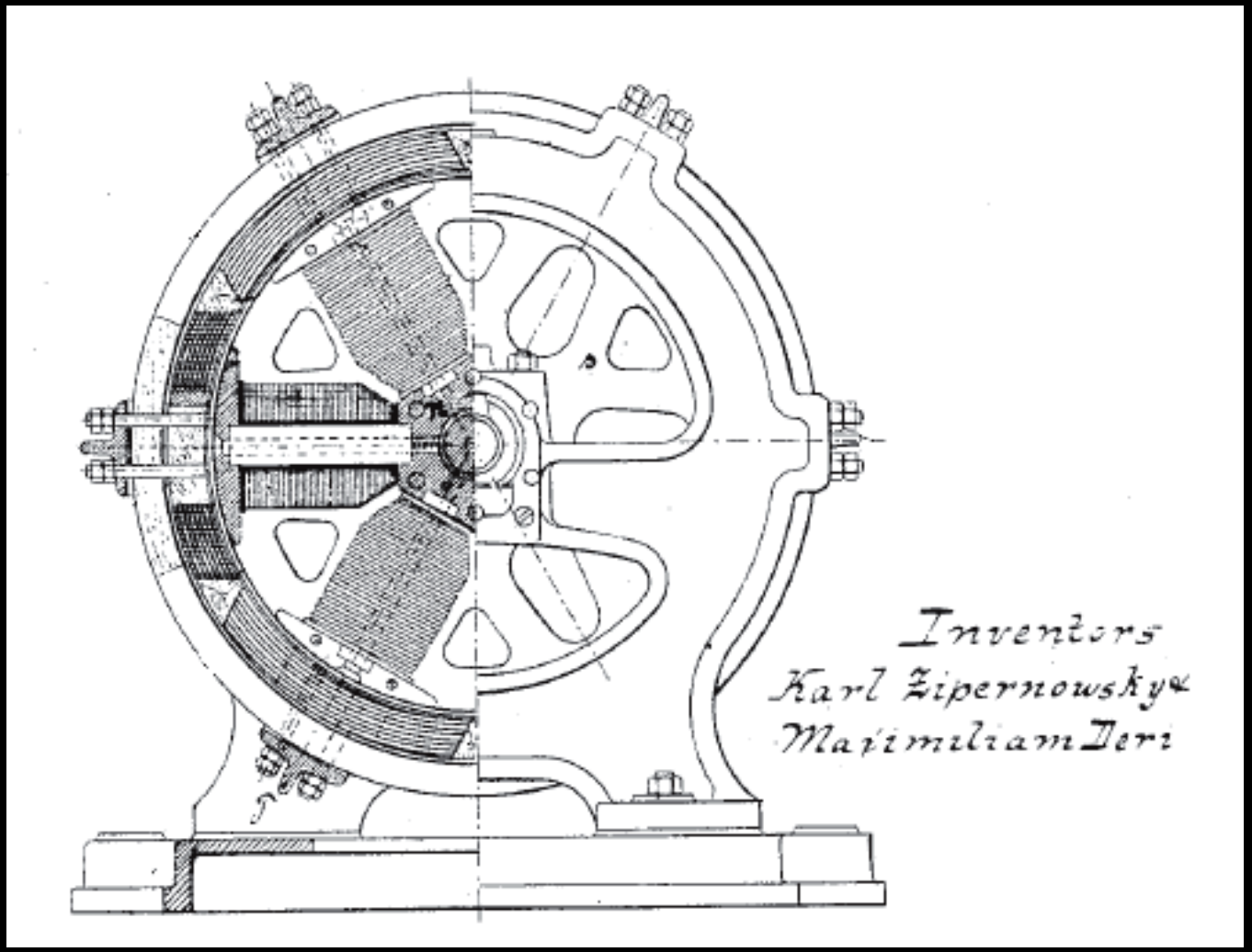
3 **Navy and green floral design highlights.** Solid green body with coordinating navy and green floral design front and back yokes, collar, pocket flaps and cuffs. 51 C 50805F—*See sizes for men and women above.* Shpg. wt. 12 oz. $9.97

4 **Navy and red patchwork highlights.** Solid blue body with navy and red front and back yokes, collar, pocket flaps and cuffs. 51 C 50803F—*See sizes for men and women above.* Shpg. wt. 12 oz. $9.97

5 **Black and brown patchwork highlights.** Natural ecru shade body with contrasting black and brown front and back yokes, collar, pocket flaps and cuffs. 51 C 50802F—*See sizes for men and women above.* Shpg. wt. 12 oz. $9.97



Çatalhöyük – c. 7500 BCE

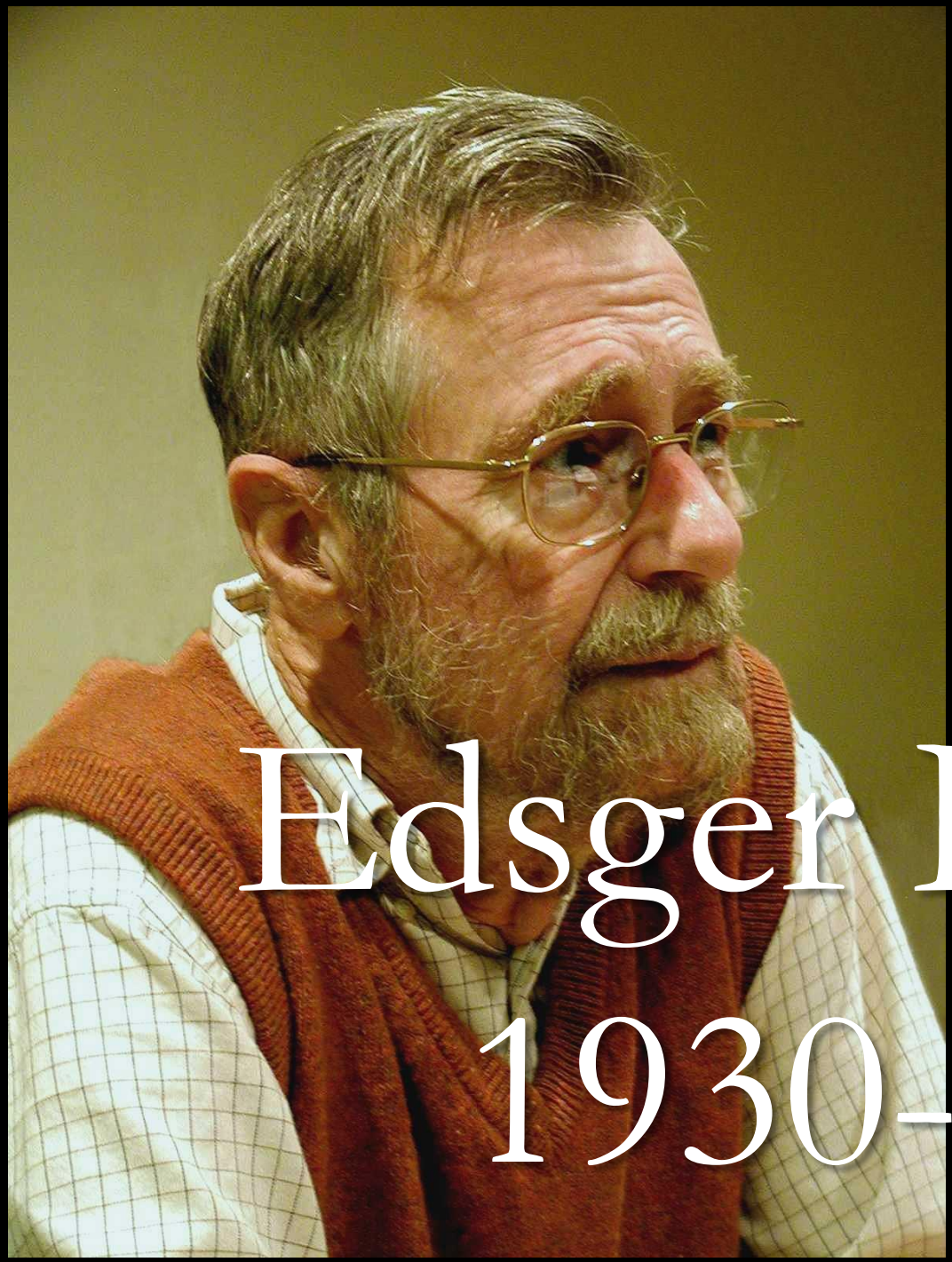


Commercial generation of electricity

Mid to late 19th century

Our field is new.

Software didn't really exist until 1945, and software engineering started in the 60s.



Edsger Dijkstra
1930-2002


NORVEGI
HORDERS
SVDERO
DV
FA
B