Abstraction

In

Programming Languages

Abstraction - Definition

- In computer science, "abstraction" reduces details so that one can focus on concepts.
- Abstraction can apply to control or to data:
 - Control Abstraction involves, for example, the use of subprograms to simplify control flow.
 - Data Abstraction involves assigning meaning to data bits or bytes within and across programs.

Bytes Integers, Rationals, Imaginaries

Bytes Characters Strings,

The requirement that a programming language provide suitable abstractions is called the

abstraction principle

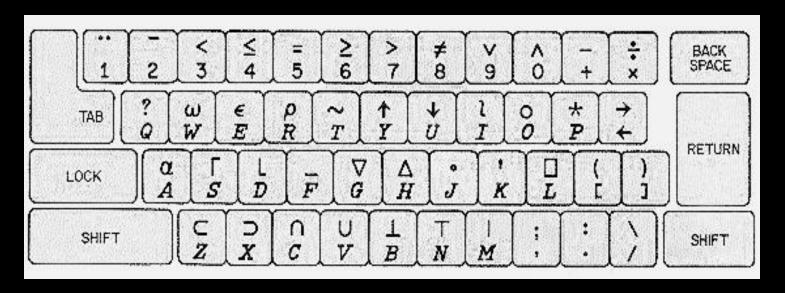
Cobol (1959)

```
** SET DAYS IN FEBRUARY **
 MOVE 28 TO DW-DAYS-IN-MONTH(2).
 DIVIDE 400 INTO DW-WORK-YYYY GIVING DW-WORK1
                            REMAINDER DW-WORK2.
 IF (DW-WORK2 = 0)
     MOVE 29 TO DW-DAYS-IN-MONTH(2)
 ELSE
     DIVIDE 100 INTO DW-WORK-YYYY GIVING DW-WORK1
                                REMAINDER DW-WORK2
     IF (DW-WORK2 NOT = 0)
          DIVIDE 4 INTO DW-WORK-YYYY GIVING DW-WORK1
                                  REMAINDER DW-WORK2
         IF (DW-WORK2 = 0)
              MOVE 29 TO DW-DAYS-IN-MONTH(2).
 IF (DW-WORK-DD < 01)
     OR
     (DW-WORK-DD > DW-DAYS-IN-MONTH (DW-WORK-MM))
     GO TO 001000-EXIT.
```

APL —<u>A Programming Language</u> (~1965)

The Sieve of Eratosthenes -The Program:

The Keyboard:



```
R+1+113
       R
         6 7 8 9 10 11 12 13
       S♦S+R•.×R
 4
          10 12 14
        8
                       16
                           18
                                20
                                     22
                                          24
                                              26
    6
 6
              18
                                     33
    9
       12
          15
                  21
                      24
                           27
                                30
                                          36
                                              39
 8
   12
       16
          20
              24
                  28
                      32
                                40
                                     44
                                              52
                           36
                                          48
       20
                      40
                                     55
10
   15
          25
              30
                  35
                           45
                                50
                                          60
                                              65
                           54
12
   18
       24
          30
              36
                 42
                      48
                                60
                                     66
                                          72
                                              78
                      56
       28
          35
                                     77
14
   21
              42
                 49
                           63
                                70
                                          84
                                              91
       32
                 56
16
   24
          40
              48
                      64
                           72
                                80
                                     88
                                          96
                                             104
18
   27
       36
                      72
                           81
                                90
                                     99
                                         108
                                             117
          45
              54
                  63
20
   30
       40
          50
              60
                  70
                      80
                           90
                               100
                                    110
                                         120
                                             130
22
              66
   33
          55
                  77
                      88
                           99
                               110
                                    121
                                         132
       44
                                             143
              72
                 84
                      96
                               120
                                    132
24
   36
       48
          60
                          108
                                         144
                                             156
      52 65 78 91 104 117
                               130
26
   39
                                   143
                                        156 169
       ~RES
      1 0 1
       (~RES)/R
```

11 13