

A Comparison of Code Densities on the 7090 and S/360 Computers

The following figures are lengths of object code generated by two FORTRAN IV (S/360-H level and 7090 IBSYS Version 13) compilers for subroutines taken from the TVGP phase of the bubble chamber program. The subroutines used were taken from the FORTRAN IV (7090) program and run under the S/360 FORTRAN IV (H) compiler with only minor conversions necessary for successful compilation. These figures are of interest in comparing the density of object code generated for the two machines from essentially identical source code. All lengths are given as decimal numbers of words.

| <u>Subroutines</u> | <u>System 360</u><br>(No. of 32-bit words) | <u>7090</u><br>(No. of 36-bit words) |
|--------------------|--|--------------------------------------|
| MAIN*              | 50   | 31                                   |
| RADIUS*            | 1579 (2076)*                               | 1388                                 |
| READL              | 1743.5                                     | 1577                                 |
| AUX                | 816.5                                      | 827                                  |
| BRACQ              | 368.5                                      | 319                                  |
| CIRCLE             | 729  | 701                                  |
| CLOT               | 102  | 64                                   |
| COLMBW             | 215.5                                      | 220                                  |
| COLOMB             | 287.5                                      | 270                                  |
| GETSET             | 439  | 471                                  |
| GPWRIT             | 2833                                       | 2739                                 |
| INIT               | 1192                                       | 1244                                 |
| INTRPQ             | 374  | 372                                  |
| IUNPAC             | 91   | 58                                   |
| LSVERT             | 1104.5                                     | 1017                                 |
| MATCH2             | 186  | 163                                  |
| MOVDWN             | 197  | 149                                  |
| MX5INV             | 345.5                                      | 298                                  |
| PINTOR             | 256.5                                      | 226                                  |

| <u>Subroutines</u> | <u>System 360</u><br>(No. of 32-bit words) | <u>7090</u><br>(No. of 36-bit words) |
|--------------------|--|--------------------------------------|
| POLAQR             | 831.5                                      | 818                                  |
| PREP               | 162.5                                      | 141                                  |
| QUAD               | 86.5                                       | 76                                   |
| RINTOP             | 267.5                                      | 240                                  |
| SCREW              | 298  | 274                                  |
| SEGMEN             | 394.5                                      | 318                                  |
| SENROT             | 110  | 65                                   |
| SPFIT              | 223.5                                      | 174                                  |
| SWIM               | 1114                                       | 1083                                 |
| TVGP               | 1535                                       | 1501                                 |
| U                  | 440  | 361                                  |
| USER               | 250  | 189                                  |
| VWFAIL             | 99   | 70                                   |
| XFORM              | 148  | 144                                  |
| ENGINE             | 94.5                                       | 48                                   |
| FDC63              | 73.5                                       | 28                                   |
| FIDO               | 486  | 456                                  |
| FIDVOL             | 471.5                                      | 421                                  |
| FIELD              | 992  | 1147                                 |
| OPTCBC             | 246  | 281                                  |
| OPTIC              | 324  | 294                                  |
| TYP SUB            | 172.5                                      | 161                                  |
| USE72              | 294.5                                      | 246                                  |
|                    | <hr/>                                      | <hr/>                                |
| TOTAL LENGTH       | 22,024                                     | 20,670                               |

The optimization level available in FORTRAN IV (H) (OPT = 2) was used for all the subroutines except those marked with an asterisk (\*), in which case OPT = 0 was specified. Note the subroutine RADIUS for which the length of code generated under both levels of optimization is given for comparison.

The overall ratio of code densities is:

$$\frac{22024}{20670} = 1.066 \quad \frac{32\text{-bit } S/360 \text{ words}}{36\text{-bit } 7090 \text{ words}}$$

In other words, the code density per bit of instruction was not significantly different from 1:1 .

The average length of object code instruction generated by the 360 FORTRAN IV (H) compiler was 3.74 bytes. This figure was calculated by using the unoptimized object code for three of the above subroutines: RADIUS, which performs straight computation, READL, which performs input/output functions, and TVGP, which functions as the main routine that directs control throughout this phase of the bubble chamber program. No instructions with the SS format (i.e., 6-byte instructions) were used in this code.