Untitled

The ENGLISH ELECTRIC Co. Ltd.

NELSON RESEARCH LABORATORIES
STAFFORD
MATHEMATICS DEPARTMENT

Tel. Stafford 700

Notes on Binary Decimal and Decimal Binary Conversion (using Brunsviga)

Report by: C. Robinson.

Technical Memorandum: NS u 242
Date: 9/9/57

1. SUMMARY.

This report gives instructions for decimal to binary and binary to decimal conversions, using a hand operated Brunsviga calculating machine.

2. DECIMAL-BINARY.

(a) Decimal Integers.

Place integer at extreme right hand side of register. Multiply by 0.03125. If last five figures of product are less than 0.75 divide the first two of these figures by three and record (without round off). If the last five figures are greater than or equal to 0.75 divide first two of these figures by 3, subtract 1 and record. Now transfer, losing last five figures. Multiply again by 0.03125 and carry on. When integral portion of

number in accumulator is less
than 32, record and stop.

Example. 123456789

123456789 x 0.03125 = 3858024.65625 Record 21

3858024 x 0.03125 = 120563.25000 Record 8

120563 x 0.03125 = 3767.59375 Record 19

3707 x 0.03125 = 117.71875 Record 23

117 x 0.03125 = 3.65625 Record 21

Therefore 123456789 = 21, 8, 19, 23, 21, 3
(Chinese binary. Groups
of
five binary digits.)

(b) Decimal Fractions.

Set number on extreme left hand side of
register. Multiply by 32 so that
when the result is transferred the integral
portion of the answer is not
transferred. Record the integral portion and
carry on to the requisite number
of binary places.

Example. Calculate Binary equivalent of 0.853012
to 25 b.p.

0.853012 x 32 = 27.296384 Record 27

0.296384 x 32 = 9.484288 Record 9

0.484288 x 32 = 15.497216 Record 15

0.497216 x 32 = 15.910912 Record 15

0.910912 x 32 = 29.149184 Record 29

Therefore 0.853023 = 29, 15, 15, 9, 27, 0 to 25 binary places.

3. BINARY-DECIMAL.

(a) Binary integers.

Write down binary integer in usual form i.e. the decimal equivalent of each group of five binary digits, most significant on the right. Take the most significant group of five binary digits and multiply the decimal equivalent by 32, add the next significant group, transfer and multiply again by 32. Repeat until least significant group has been added in (Note the last operation is an addition not a multiplication)

Example. Find decimal equivalent of the binary integer, 21, 8, 19, 23, 21, 3.

3 x 32 = 96 Add 21

117 x 32 = 3744 Add 23

3767 x 32 = 120544 Add 19

120563 x 32 = 3858016 Add 8

3858024 x 32 = 123456768 Add 21

Therefore, answer = 123456789

(b) Binary Fractions.

Set least significant group on left hand side of register. Multiply by 0.03125. Transfer and add the next least significant group to the result as a decimal integer. Multiply by 0.03125 and continue.

Example.

Find decimal equivalent of the binary fraction 29, 15, 15, 9, 27.0.

29 x .03125 = 0.90625

15.90625 x .03125 = 0.4970703125

15.4970703125 x .03125 = 0.4842834472

.4842834472 x .03125 = 0.2963838577

27.2963838577 x .03125 = 0.8530119956 = 0.853012 rounded off.

Signed: C Robinson
MATHEMATICS DEPARTMENT