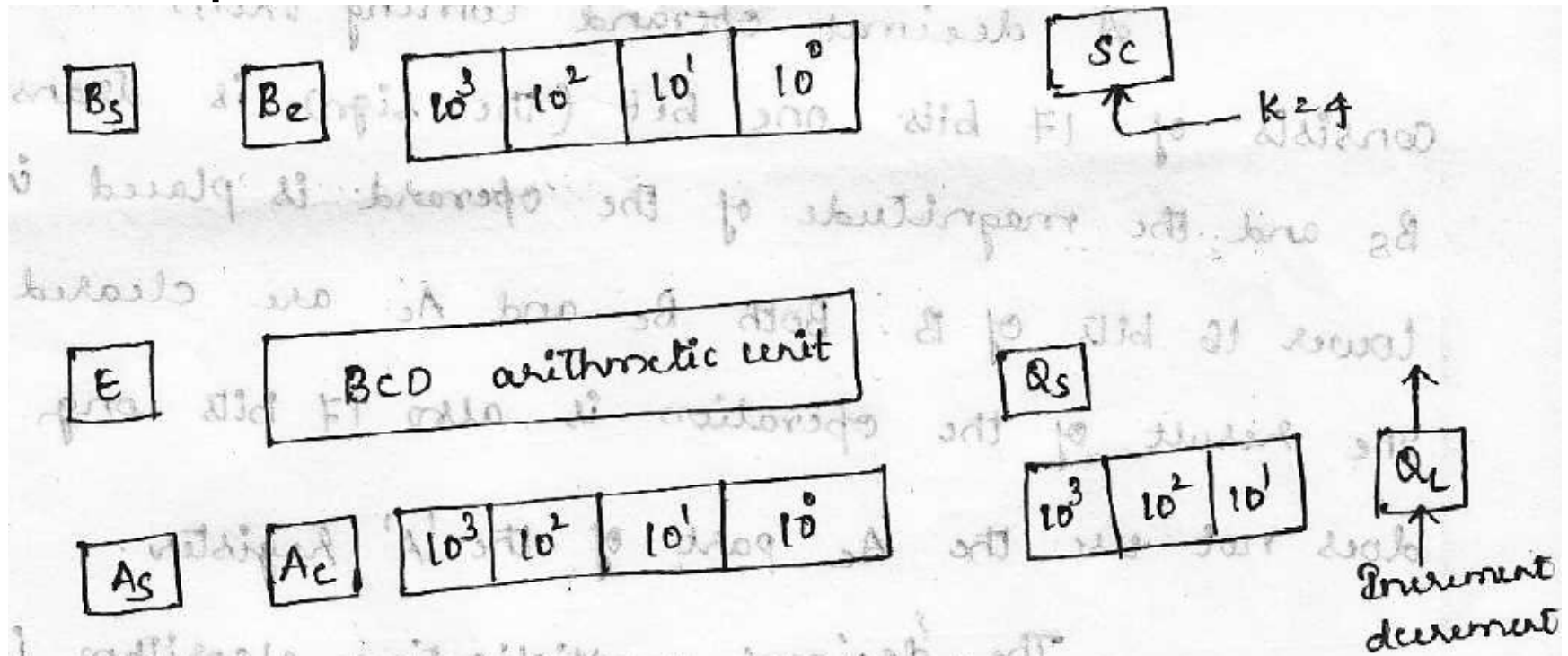


BCD Multiplication and Division

BCD Multiplication

- The register configuration for decimal multiplication is shown below



BCD Multiplication

- Assuming here the 4 digit number with each digit occupying 4 bits for a total of 16 bits of each number.
- There are 3 registers A, B, and Q each having corresponding flip-flops A_s , B_s and Q_s .
- Registers A and B have four more bits designated by A_e and B_e that provides an extension of one more digit to the registers.
- The BCD arithmetic unit adds five digit in parallel and places the sum in five digit A register and the end carry goes to E flip-flops.

BCD Multiplication

- The least significant digit in register Q is designated by QL which is incremented or decremented.
- The decimal multiplication algorithm is shown below

BCD Multiplication

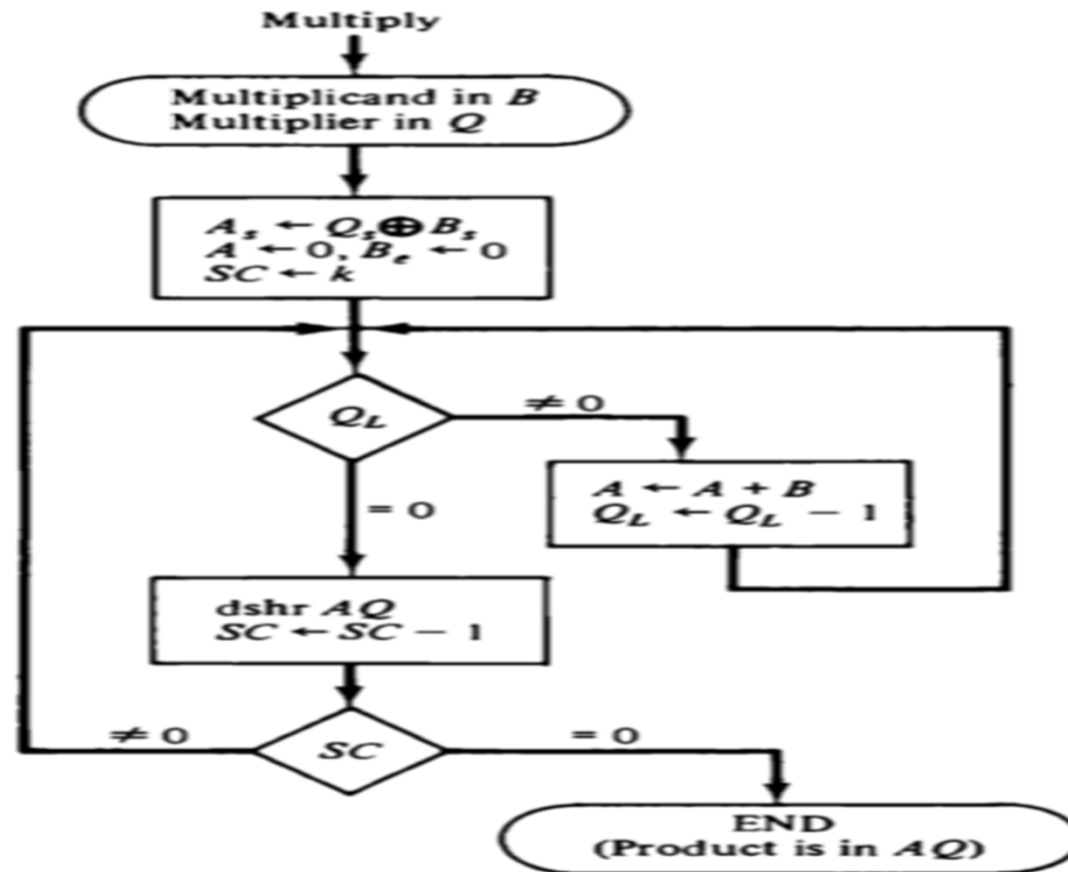


Figure 10-22 Flowchart for decimal multiplication.

BCD Multiplication

- Initially A register and Be are cleared and SC is set to a number K equal to number of digits in multiplier.
- Least Significant digit of multiplier in QL is checked, if it is not equal to 0, multiplicand in B is added to partial product in A and QL is decremented.
- QL is checked again and process is repeated until it is equal to 0.
- The partial product and multiplier are shifted once to the right and SC is decremented.
- The process is repeated K times to form double length product in AQ.

BCD Division

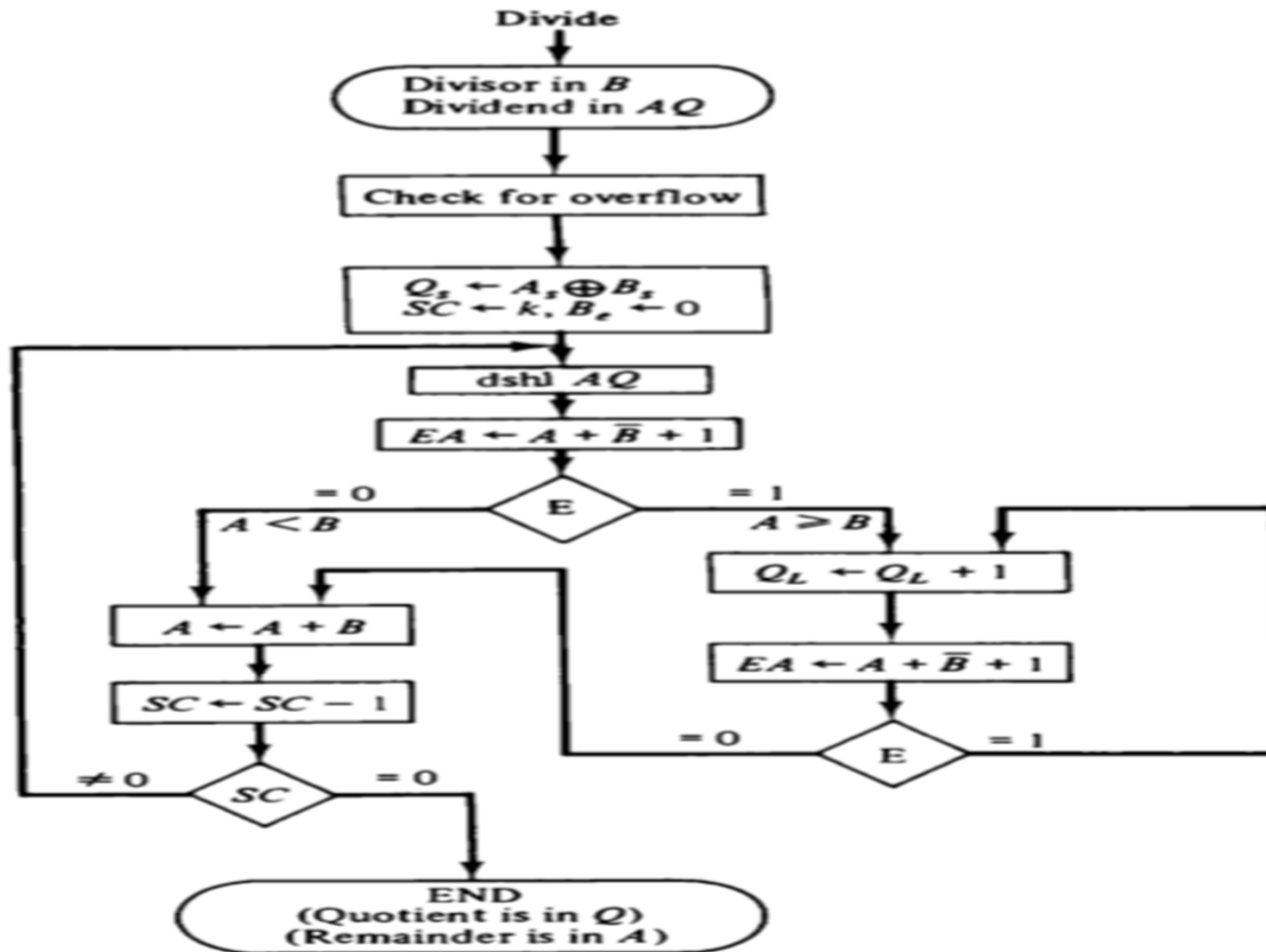


Figure 10-23 Flowchart for decimal division.

BCD Division

- The algorithm can be summarized as follows:
 1. Load the divisor into B register, dividend into AQ register, SC with K number of digits in divisor and register Be cleared to zero.
 2. Perform dshl AQ one time.
 3. Perform the subtract operation
$$EA \leftarrow A + B' + 1$$
 4. E value is checked whether it is equal to 0.
 5. if it does B is added back to A, SC is decremented by one and control goes to step 8.
$$A \leftarrow A + B$$
 6. Otherwise QL is incremented by 1 and perform the subtract operation
$$QL \leftarrow QL + 1$$
$$EA \leftarrow A + B' + 1$$
 7. E value is checked whether it is equal to 0, if it does the control goes to step 5 otherwise the process in step 6 continues.
 8. SC is checked, if it is not equal to 0 the control goes to step 3 otherwise process stops and quotient will be in Q and Remainder will be in A.