

- You must write down / type the calculations, or you won't get the scores.
- 請用手寫於 A4 紙上,並掃描上傳至 i 學園
- 請勿抄襲,抄襲者與被抄襲者單一分數取平均

1.(18%) Please calculate 147 divided by 28 using the hardware described in Figure 5. (Assume 147 and 28 are decimal numbers). You should show the contents of each register on each step. Assume A and B are unsigned 8-bit integers. You will want to think hard about this, do an experiment or two, or else go to the web to figure out how to make this work correctly. (Hint: one possible solution involves using the fact that Figure 5. implies the remainder register can be shifted either direction.)

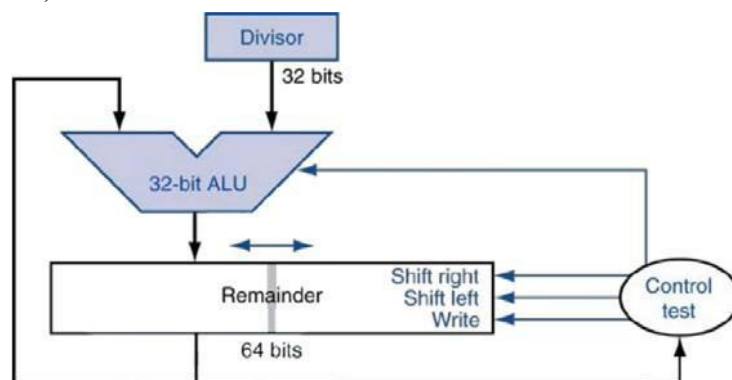
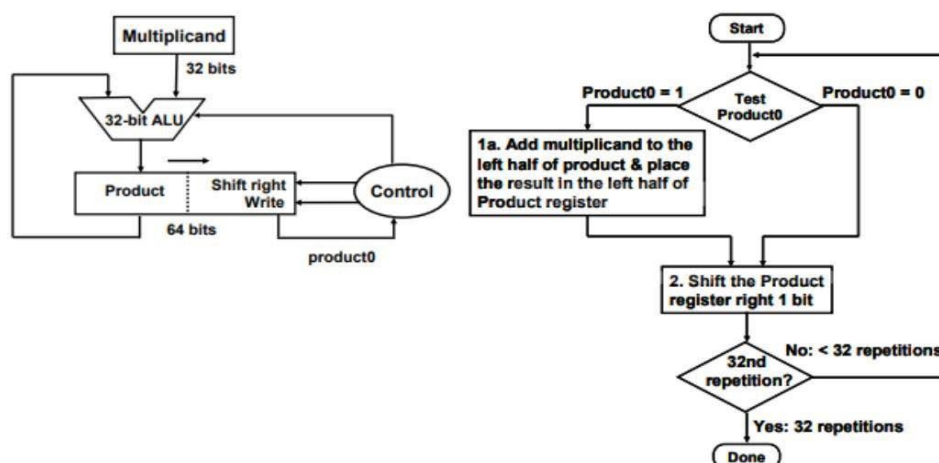


Figure 5. Division hardware

Iteration	Step	Remainder(R)	Divisor
0			
1			
2			
...			
n			

2.(20%) Given the hardware and the flow chart of a multiplication algorithm,



(a)(8%) Modify the hardware as less as possible for Booth's multiplication algorithm.
Draw the modified hardware.

(b)(7%) Based on the modified hardware designed in (a), redraw the flow chart for Booth's multiplication algorithm.

(c)(5%) Describe the characteristics and advantages of Booth's algorithm.

3.(40%) Given the IEEE-754 single precision floating - point operand format as follows,

Sign (s)	Exponent (e)	Fraction (f)
1 bit	8 bits	23 bits

(a)(6%) What is the decimal number -23.25 represented in binary number?

(b)(6%) If sign=1, exponent =01111001, and significand = 0110100000000000000000.
What is the decimal number?

(c)(5%) What is the largest positive normalized number in IEEE-754?

(d)(5%) What is the smallest positive denormalized number in IEEE-754?

(e)(12%) What are the $\pm\infty$ and NaN in IEEE-754 Single Precision?

Sign	Exponent	Fraction	Object represented

(f)(6%) Convert the IEEE 754 single precision floating-point number 0xC102B1F2, represented in hexadecimal, to its equivalent decimal number.

4.(22%) IEEE 754-2008 contains a half precision that is only 16 bits wide. The left most bit is still the sign bit, the exponent is 5 bits wide and has a bias of 15, and the mantissa is 10 bits long. A hidden 1 is assumed.

(a)(6%) Write down the bit pattern to represent -1.3125 assuming a version of IEEE 754-2008 format.

(b)(8%) Calculate the sum of 1.5225×10^2 and $3.330078125 \times 10^{-1}$ by hand. Assume 1 guard, 1 round bit, and 1 sticky bit, and round to the nearest even. Show all the steps.

(c)(8%) Calculate the product of 0.64453125×10^1 and 840.625×10^{-2} by hand. Assume 1 guard, 1 round bit, and 1 sticky bit, and round to the nearest even. Show all the steps.