

CSSE2010 Bible

By Samuel Allpass

A person smiling for a picture

AI-generated content may be incorrect.

# Dr Hui MaQuestion 1

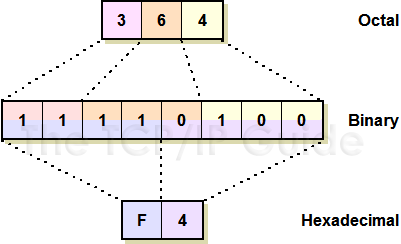
A table of binary format

AI-generated content may be incorrect.Ones Comp: Invert all the bits

Twos Comp: Invert all the bits and add 1

Excess – x: Add x to number then convert to binary, or vice versa





# A screenshot of a computer AI-generated content may be incorrect.Question 2

# Question 3

A whiteboard with red writing

AI-generated content may be incorrect.Greycode = binary with different ordering. I.E. same number of flip flops to store states.

One-hot encoding = 1 flip flop per state. 0001, 0010, 0100, 1000. 4 flip flops, 4 states.

Invalid states = Any unused state combinations.

# Question 4

ALU Type 1

4 control bits on A and B (EN and INV)

A diagram of a machine

AI-generated content may be incorrect.A diagram of a machine

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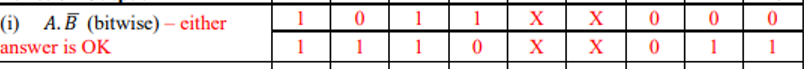
Table outputs using diagram with output 7 = right shift in

X means don’t care

There may be many ways to do these (can add a second line with other ways)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Function | ENA | INVA | ENB | INVB | Carry In | Right Shift In | F2 | F1 | F0 | Output Name |
| Logical Functions: | | | | | | | | | | |
|  | 1 | 1 | X | X | X | X | 1 | 0 | 0 | Not |
|  | 1 | 0 | X | X | X | X | 1 | 0 | 0 | Not |
|  | 0 | 1 | 1 | 0 | X | X | 0 | 0 | 1 | Or |
|  | 0 | 1 | 1 | 1 | X | X | 0 | 0 | 1 | Or |
| = | 1 | 0 | 1 | 0 | X | X | 0 | 0 | 0 | And |
| (could also do with NAND) | 1 | 1  0 | 1 | 1  0 | X | X | 0 | 0  1 | 1  0 | Or  Nand |
|  | 1 | 1 | 1 | 1 | X | X | 0 | 0 | 0 | And |
| Shift Functions: | | | | | | | | | | |
| B\*2 (Logical Shift Left of B) | 0 | 1 | 1 | 0 | 0 | X | 1 | 1 | 0 | Carry |
| A\*2 (Logical Shift Left of A) | 1 | 0 | 0 | 1 | 0 | X | 1 | 1 | 0 | Carry |
| A/2 (Logical Shift Right of A)  (A is unsigned and even) | 1 | 0 | X | X | X | 0 | 1 | 1 | 1 | Shift |
| B/2 (Logical Shift Right of B) | Not possible because the right shift is only connected to A | | | | | | | | | |
| Arithmetic Functions: | | | | | | | | | | |
| Increment A (A+1) | 1 | 0 | 0 | 0 | 1 | X | 1 | 1 | 0 | Carry |
| Increment B (B+1) | 0 | 0 | 1 | 0 | 1 | X | 1 | 1 | 0 | Carry |
| Decrement B (B-1) = (~A+B-1) | 1 | 1 | 1 | 0 | 1 | X | 1 | 1 | 0 | Carry |
| A+B+1 | 1 | 0 | 1 | 0 | 1 | X | 1 | 1  0 | 0  1 | Carry |
| A-B-1 | 1 | 0 | 1 | 1 | 0 | X | 1 | 0 | 1 | Adder |
| Other: | | | | | | | | | | |
| Constant -2 in 2’s comp | 0 | 1 | 0 | 1 | 0 | X | 1 | 0 | 1 | Adder |
| Constant -1 in 2’s comp = constantly output 1 | 0 | 0 | X | X | X | X | 1 | 0 | 0 | Not |

^^This colour shows an alternate solution Cannot do:



# ALU Type 2

3 Control bits, missing INVA

A diagram of a machine

AI-generated content may be incorrect.A diagram of a computer

AI-generated content may be incorrect.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Function | ENA | INVA | ENB | Carry In | Right Shift In | F2 | F1 | F0 | Output Name |
| Logical Functions: (these have been done using diagram on left) | | | | | | | | | |
|  | 1 | 0 | 0 | X | X | 0 | 0 | 1 |  |
|  | 1 | 1 | 0 | X | X | 0 | 0 | 1 |  |
|  | 0 | 1 | 1 | X | X | 0 | 0 | 0 |  |
|  | X | X | 1 | X | X | 1 | 1 | 0 |  |
| = | 1 | 0 | 1 | X | X | 0 | 0 | 0 |  |
| = | 1 | 0 | 1 | X | X | 0 | 1 | 1 |  |
| Shift Functions: | | | | | | | | | |
| B\*2 (Logical Shift Left of B) | Not Possible | | | | | | | | |
| A\*2 (Logical Shift Left of A) | 1 | 0 | 1 | 0 | X | 1 | 0 | 0 | Carry |
| A/2 (Logical Shift Right of A)  (A is unsigned and even) | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | Shift |
| B/2 (Logical Shift Right of B) | Not Possible | | | | | | | | |
| Arithmetic Functions: | | | | | | | | | |
| Increment A (A+1) | 1 | 0 | 0 | 1 | X | 1 | 1 | 1 | Adder |
| Decrement B (B-1) | 0 | 1 | 1 | 0 | X | 1 | 1 | 1 | Adder |
| A+B+1 | 1 | 0 | 1 | 1 | X | 1 | 1 | 1 | Adder |
| Other: | | | | | | | | | |
| Constant -2 in 2’s comp | Not possible? As there is no INVB | | | | | | | | |