# ECE124: Discussion

Discussion #3

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1.23 Represent the unsigned decimal numbers 791 and 658 in BCD and then show the steps necessary to form their sum.

8421 code

0111 1001 0001 0110 0101 1000
791 658

```
  0111 1001 0001
+ 0110 0101 1000
-----------------
  1110 1110 1001
+ 1101 0110
-----------------
  0110
-----------------
0001 0101 0100 1001
```

1.24 Formulate a weighted binary code for the decimal digits, using the following weights. (a) 6,3,1,1 (b) 6,4,2,1

| Decimal | 6 3 1 1 | 6 4 2 1 |
|---|---|---|
| 0 | 0000 | 0000 |
| 1 | 0001 | 0001 |
| 2 | 0011 | 0010 |
| 3 | 0100 | 0011 |
| 4 | 0101 | 0100 |
| 5 | 0111 | 0101 |
| 6 | 1000 | 0110 |
| 7 | 1001 | 0111 |
| 8 | 1011 | 1000 |
| 9 | 1111 | 1001 |

Write the expression “G. Boole” in ASCII using 8-bit code (including the period and space). Treat the leftmost bit of each character as a parity bit (odd parity).

G 1100 0111
. 1010 1110
sp 0010 0000
B 1100 0010
o 1110 1111
o 1110 1111
l 1110 1100
e 1110 0101

*USASCII code chart*

| Bits $b_7 b_6 b_5$ → | 000 | 001 | 010 | 011 | 100 | 101 | 110 | 111 |
|---|---|---|---|---|---|---|---|---|
| $b_4$ $b_3$ $b_2$ $b_1$ ↓ Row / Column → | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 0 0 0 0 | 0 | NUL | DLE | SP | 0 | @ | P | ` | p |
| 0 0 0 1 | 1 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 0 0 1 0 | 2 | STX | DC2 | " | 2 | B | R | b | r |
| 0 0 1 1 | 3 | ETX | DC3 | # | 3 | C | S | c | s |
| 0 1 0 0 | 4 | EOT | DC4 | $ | 4 | D | T | d | t |
| 0 1 0 1 | 5 | ENQ | NAK | % | 5 | E | U | e | u |
| 0 1 1 0 | 6 | ACK | SYN | & | 6 | F | V | f | v |
| 0 1 1 1 | 7 | BEL | ETB | ' | 7 | G | W | g | w |
| 1 0 0 0 | 8 | BS | CAN | ( | 8 | H | X | h | x |
| 1 0 0 1 | 9 | HT | EM | ) | 9 | I | Y | i | y |
| 1 0 1 0 | 10 | LF | SUB | * | : | J | Z | j | z |
| 1 0 1 1 | 11 | VT | ESC | + | ; | K | [ | k | { |
| 1 1 0 0 | 12 | FF | FS | , | < | L | \ | l | \| |
| 1 1 0 1 | 13 | CR | GS | - | = | M | ] | m | } |
| 1 1 1 0 | 14 | SO | RS | . | > | N | ^ | n | ~ |
| 1 1 1 1 | 15 | SI | US | / | ? | O | _ | o | DEL |

1.33 The state of a 12-bit register is **100010010111**. what is its content if it represents:

(d) A binary number?

2199

2^11+2^7+2^4+2^2+2^1+2^0 = 2199

1000 8

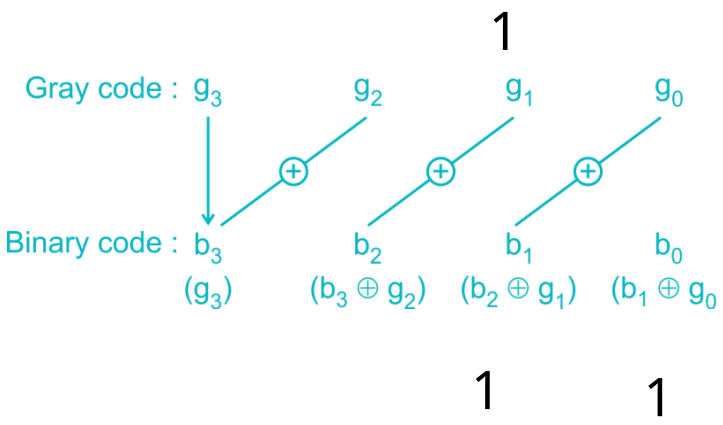
1001 7

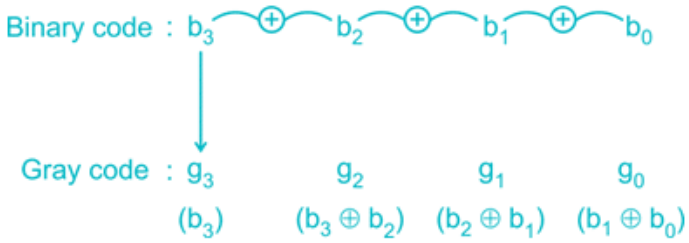
0111 1

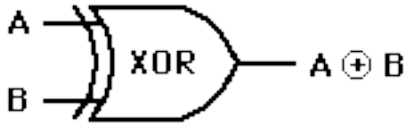
871

# Gray code

| Binary | | | | Gray Code | | | |
|---|---|---|---|---|---|---|---|
| $b_3$ | $b_2$ | $b_1$ | $b_0$ | $g_3$ | $g_2$ | $g_1$ | $g_0$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |




| A | B | Out |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

- The state of a 12-bit register is **100010010111**. what is its content if it represents a 12-bit Gray code?

100010010111

111...

**Image from:**
http://hydrogen.physik.uni-wuppertal.de/hyperphysics/hyperphysics/hbase/electronic/xor.html
https://www.geeksforgeeks.org/digital-logic-code-converters-binary-gray-code/
https://testbook.com/blog/conversion-from-gray-code-to-binary-code-and-vice-versa/
https://ncalculators.com/digital-computation/binary-gray-code-converter.htm

2.1 Demonstrate the validity of the following identities by means of truth tables:

or function

(b) The distributive law: x + yz = (x + y)(x + z)

| x y z | y z | x+yz | x+y | x+z | (x+y)(x+z) |
|---|---|---|---|---|---|
| 000 | | | | | |
| 001 | | | | 1 | |
| 010 | | | 1 | | |
| 011 | 1 | 1 | 1 | 1 | 1 |
| 100 | | 1 | 1 | 1 | 1 |
| 101 | | 1 | 1 | 1 | 1 |
| 110 | | 1 | 1 | 1 | 1 |
| 111 | 1 | 1 | 1 | 1 | 1 |

2.1 Demonstrate the validity of the following identities by means of truth tables:

(c) The distributive law: x(y + z) = xy + xz

| x y z | y+z | x(y+z) | xy | xz | xy+xz |
|---|---|---|---|---|---|
| 000 | | | | | |
| 001 | 1 | | | | |
| 010 | 1 | | | | |
| 011 | 1 | | | | |
| 100 | | | | | |
| 101 | 1 | 1 | | 1 | 1 |
| 110 | 1 | 1 | 1 | | 1 |
| 111 | 1 | 1 | 1 | 1 | 1 |

2.1 Demonstrate the validity of the following identities by means of truth tables:

(d) The associative law: x + (y + z) = (x + y) + z

| x y z | y+z | x+(y+z) | x+y | (x+y)+z |
|---|---|---|---|---|
| 000 | | | | |
| 001 | 1 | 1 | | 1 |
| 010 | 1 | 1 | 1 | 1 |
| 011 | 1 | 1 | 1 | 1 |
| 100 | | 1 | 1 | 1 |
| 101 | 1 | 1 | 1 | 1 |
| 110 | 1 | 1 | 1 | 1 |
| 111 | 1 | 1 | 1 | 1 |

2.1 Demonstrate the validity of the following identities by means of truth tables:

(e) The associative law: x(yz) = (xy)z

| $x$ | $y$ | $z$ | $yz$ | $x(yz)$ | $xy$ | $(xy)z$ |
|---|---|---|---|---|---|---|