RGB Color Code – selected colors expressed in hexadecimal & decimal values

- **Red** **255:0:0** **FF0000**
- **Green** **0:255:0** **00FF00**
- **Blue** **0:0:255** **0000FF**
- **White** **255:255:255** **FFFFFF**
- **Black** **0:0:0** **000000**
- **describe the essential characteristic of all shades of gray**

n:n:n for ((n >= 0) & (n <= 255))
or
xxxxxx for ((x >= 0) & (x <= F))

The RGB for one shade of sea green is 99CC66 or 153:204:102.
The RGB for one shade of sea blue is 6699FF or 102:153:255.

What is the color specification that describes the color which is produced by changing the sea green color toward the sea blue color by

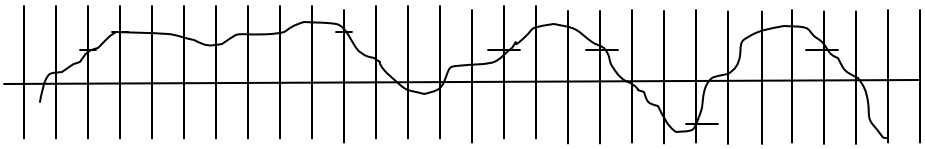
- **reducing the red component of the sea green color by 50% of the difference between the two colors**
- **reducing the green component of the sea green color by 25% of the difference between the two colors**
- **increasing the blue component of the sea green color by 25% of the difference between the two colors**

153	204	102
102	153	255
51	51	-153
$\Delta\downarrow$ 50%	$\Delta\downarrow$ 25%	$\Delta\uparrow$ 25%
51 / 2 ≈ 25	51 / 4 ≈ 13	-153 / 4 ≈ -38
153	204	102
-25	-13	+38
128	191	140

Answer: 128:188:140

Describe how analog sound waves are converted to digital representation. What role does the Nyquist Rule play in the conversion process?

The analog sound wave must be sampled at regular intervals, i.e., the amplitude is measured at each interval and the two numbers are stored in digital form, i.e., sequences of bi-tuples <time interval, amplitude>.



Amplitude is a measure of the "Sound Pressure".

The Nyquist Rule states that the Sampling Rate must be at least twice as fast as the fastest frequency being recorded. That means that the distances between the intervals must be ½ of the shortest wave length being recorded.
Since

$$wavelength = \frac{1}{frequency}$$

then the Nyquist Rule can be restated as follows: the sampling intervals must be at least ½ of the shortest wavelength.

Since human perception of sound is limited to approximately 20,000 Hz or 20 GHz, the standardized digital audio recording frequency of 44,100 Hz captures most of the sound which can be heard by the normal human ear.

Number Systems

Decimal	Octal	Binary	Hexadecimal
0	0	0000	0
1	1	0001	1
2	2	0010	2
3	3	0011	3
4	4	0100	4
5	5	0101	5
6	6	0110	6
7	7	0111	7
8	10	1000	8
9	11	1001	9
10	12	1010	A
11	13	1011	B
12	14	1100	C
13	15	1101	D
14	16	1110	E
15	17	1111	F

Conversions

Octal ↔ Binary ↔ Hexadecimal

765_8 ↔ 111 110 101 ↔ 0001 1111 0101 ↔ $1F5_{16}$

groups of three groups of four

Conversions

Decimal → Base n

Successive Divisions of the Decimal Number by n, preserving the remainders

65_{10} → X_5

5 | 65

5 | 13 0

2 → 3

65_{10} → 230_5

Base n ➔ Decimal

Polynomial Expansion

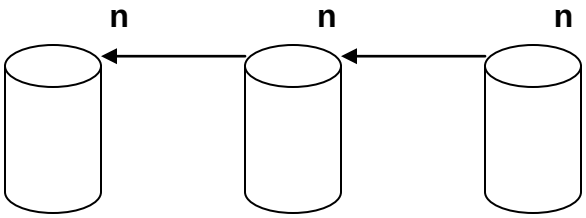
230_5 ➔ 2 3 0 $_5$ ➔ $2*5^2 + 3*5^1 + 0*5^0$ ➔ 50 + 15 + 0 ➔ 65_{10}

Base
Index 2 1 0

Coefficient * Index^{Base} + Coefficient * Index^{Base} + …

Addition

Base n ➔ (1) dump the bucket when it has n stones in it;
(2) add one stone to the bucket on the left



Subtraction

“Take Away”

When bucket is empty for Base n ➔

(1) remove one stone from the bucket on the left
(2) place n stones in the bucket that was empty