


A deep-field astronomical image showing a vast field of galaxies in various colors (blue, orange, white) against a black background. Two horizontal blue lines frame the central text.


COMMON NUMBER SYSTEMS

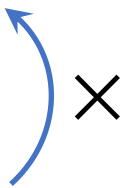
A cosmic background image featuring a dense field of galaxies in various colors (blue, orange, white) against a black space. Two horizontal blue lines are positioned above and below the central text.


BINARY | BASE-2 | RADIX-2
 $(0,1)_2$

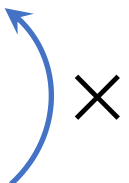
1	0	1	0	1	1	0	1	
---	---	---	---	---	---	---	---	--

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	
1×2^7	0×2^6	1×2^5	0×2^4	1×2^3	1×2^2	0×2^1	1×2^0	

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	
1×2^7	0×2^6	1×2^5	0×2^4	1×2^3	1×2^2	0×2^1	1×2^0	Σ
								173


2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
3	0	3	0	2	1	3	1	
								Σ

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
3	0	3	0	2	1	3	1	
3×2^7	0×2^6	3×2^5	0×2^4	2×2^3	1×2^2	3×2^1	1×2^0	Σ
								-



LET'S COUNT IN BINARY


$(\begin{array}{c} \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \\ \cdot \cdot \cdot \cdot \cdot \end{array})_2$


A cosmic background image featuring a dense field of galaxies in various colors (yellow, orange, blue, red) against a black space. Two horizontal blue lines frame the central text.


OCTAL | BASE-8 | RADIX-8
(0,1,2,3,4,5,6,7)₈

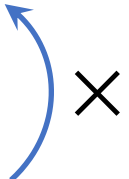
3	0	3	0	2	1	3	1	
---	---	---	---	---	---	---	---	--

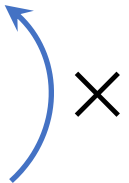
8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
3	0	3	0	2	1	3	1	

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
3	0	3	0	2	1	3	1	
3×8^7	0×8^6	3×8^5	0×8^4	2×8^3	1×8^2	3×8^1	1×8^0	

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
3	0	3	0	2	1	3	1	
3×8^7	0×8^6	3×8^5	0×8^4	2×8^3	1×8^2	3×8^1	1×8^0	Σ
								6,390,873

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
3	0	A	0	9	1	3	1	
								Σ

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
3	0	A	0	8	1	3	1	
3×8^7	0×8^6	$A \times 8^5$	0×8^4	8×8^3	1×8^2	3×8^1	1×8^0	Σ
								-

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
1	0	1	0	1	1	0	1	
1×8^7	0×8^6	1×8^5	0×8^4	1×8^3	1×8^2	0×8^1	1×8^0	Σ
								2,130,497

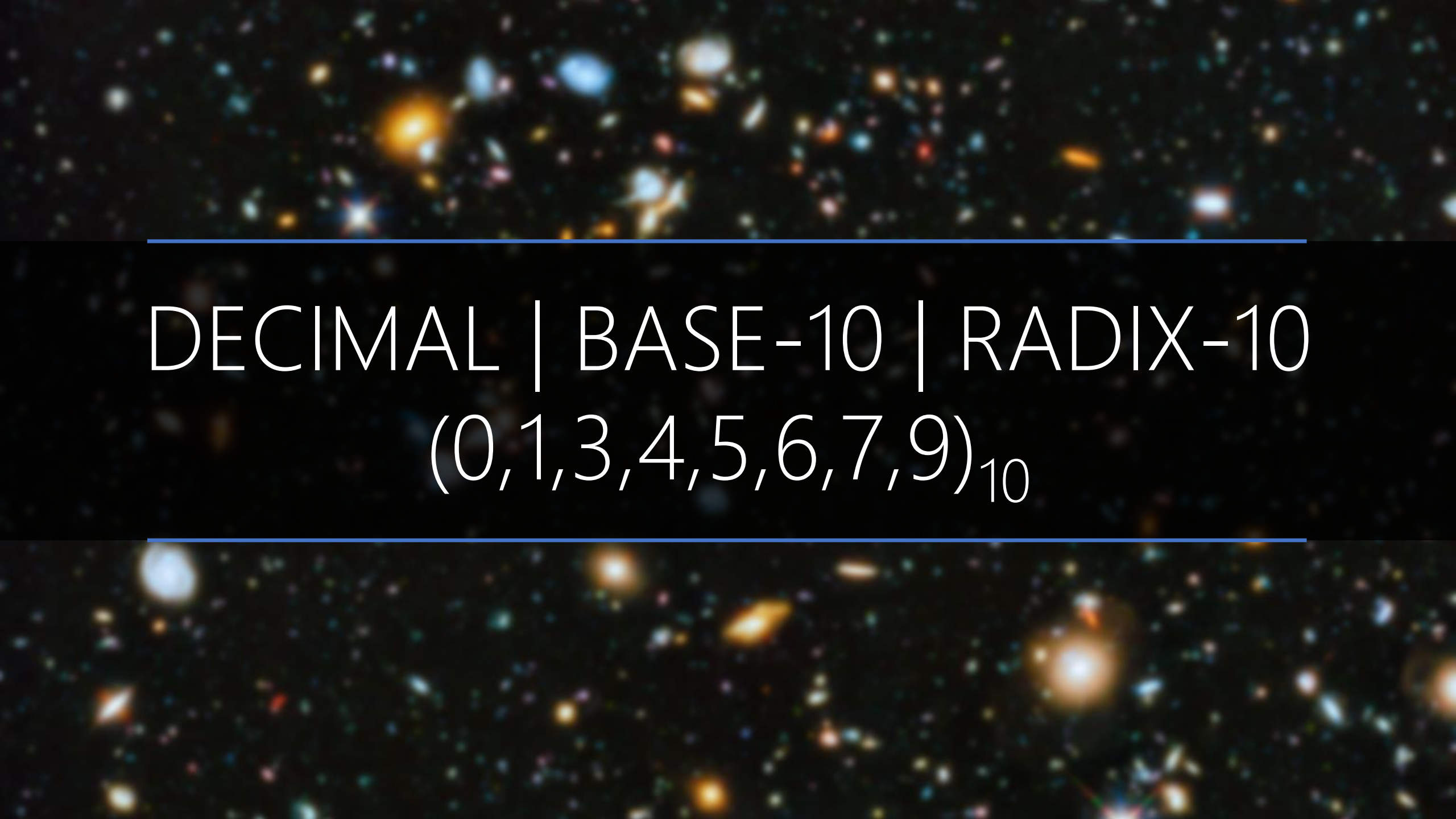
Radix-8
vs.
Radix-2

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	
1×2^7	0×2^6	1×2^5	0×2^4	1×2^3	1×2^2	0×2^1	1×2^0	
								173



LET'S COUNT IN OCTAL

$(\begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix})_8$

A cosmic background image featuring a dense field of galaxies in various colors (blue, orange, white) against a black space. A solid black horizontal band runs across the middle of the image, serving as a background for the text.

DECIMAL | BASE-10 | RADIX-10
(0,1,3,4,5,6,7,9)₁₀

0123456789

•।ᳵ᳜᳝᳞᳟᳚᳛᳠᳡᳢᳣᳤᳥᳦᳧᳨ᳩᳪᳫᳬ᳭ᳮᳯᳰᳱᳲᳳ᳴ᳵᳶ᳷᳸᳹ᳺ᳻᳼᳽᳾᳿᳠᳡᳢᳣᳤᳥᳦᳧᳨ᳩᳪᳫᳬ᳭ᳮᳯᳰᳱᳲᳳ᳴ᳵᳶ᳷᳸᳹ᳺ᳻᳼᳽᳾᳿

I II III IV V VI VII VIII IX X

᳠᳡᳢᳣᳤᳥᳦᳧᳨ᳩᳪᳫᳬ᳭ᳮᳯᳰᳱᳲᳳ᳴ᳵᳶ᳷᳸᳹ᳺ᳻᳼᳽᳾᳿


᳠᳡᳢᳣᳤᳥᳦᳧᳨ᳩᳪᳫᳬ᳭ᳮᳯᳰᳱᳲᳳ᳴ᳵᳶ᳷᳸᳹ᳺ᳻᳼᳽᳾᳿


᳠᳡᳢᳣᳤᳥᳦᳧᳨ᳩᳪᳫᳬ᳭ᳮᳯᳰᳱᳲᳳ᳴ᳵᳶ᳷᳸᳹ᳺ᳻᳼᳽᳾᳿


○一 二 三 四 五 六 七 八 九

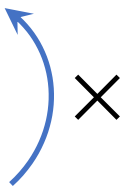
3	0	3	0	2	1	3	1	
---	---	---	---	---	---	---	---	--

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	3	0	2	1	3	1	

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	3	0	2	1	3	1	
3×10^7	0×10^6	3×10^5	0×10^4	2×10^3	1×10^2	3×10^1	1×10^0	

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	3	0	2	1	3	1	
3×10^7	0×10^6	3×10^5	0×10^4	2×10^3	1×10^2	3×10^1	1×10^0	Σ
								30,302,131

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	3	0	2	1	3	1	
3×10^7	0×10^6	3×10^5	0×10^4	2×10^3	1×10^2	3×10^1	1×10^0	Σ
								30,302,131

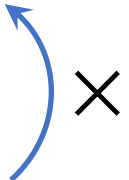
10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
1	0	1	0	1	1	0	1	
1×10^7	0×10^6	1×10^5	0×10^4	1×10^3	1×10^2	0×10^1	1×10^0	Σ
								10,101,101

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
1	0	1	0	1	1	0	1	
1×10^7	0×10^6	1×10^5	0×10^4	1×10^3	1×10^2	0×10^1	1×10^0	
								10,101,101

8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
1	0	1	0	1	1	0	1	
1×8^7	0×8^6	1×8^5	0×8^4	1×8^3	1×8^2	0×8^1	1×8^0	
								2,130,497

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	
1×2^7	0×2^6	1×2^5	0×2^4	1×2^3	1×2^2	0×2^1	1×2^0	
								173

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	A	0	8	1	3	1	\times
								Σ

10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
3	0	A	0	8	1	3	1	
3×10^7	0×10^6	$A \times 10^5$	0×10^4	8×10^3	1×10^2	3×10^1	1×10^0	Σ
								-

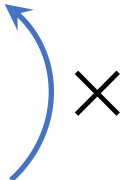


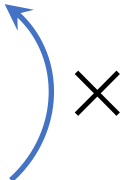
YOU KNOW HOW TO COUNT IN DECIMAL!


$$(\begin{array}{c} \cdot \cdot \cdot \\ \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \\ \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \\ \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{array} \begin{array}{c} \cdot \cdot \cdot \\ \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{array})_{10}$$


A cosmic background image featuring a dense field of galaxies in various colors (blue, orange, white) against a black space. A solid black horizontal band runs across the middle of the image, serving as a background for the text.


HEXADECIMAL | BASE-16 | RADIX-16
(0,1,3,4,5,6,7,9,A,B,C,D,E,F)₁₆


16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	
3	0	A	0	9	1	3	1	
								Σ

16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	
3	0	A	0	9	1	3	1	
3×16^7	0×16^6	$A \times 16^5$	0×16^4	9×16^3	1×16^2	3×16^1	1×16^0	Σ

16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	
3	0	A	0	9	1	3	1	
3×16^7	0×16^6	$A \times 16^5$	0×16^4	9×16^3	1×16^2	3×16^1	1×16^0	Σ

 $A = (9 + 1) = (10)_{10}$

16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	 \times
3	0	A	0	9	1	3	1	
3×16^7	0×16^6	$A \times 16^5$	0×16^4	9×16^3	1×16^2	3×16^1	1×16^0	Σ
								815,829,297

 $A = (9 + 1) = (10)_{10}$

$$1, 2, 3, 4, 5, 6, 7, 8, 9, A = 9 + 1 = (10)_{10}$$

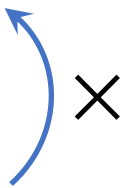
$$B = A + 1 = (11)_{10}$$

$$C = B + 1 = (12)_{10}$$

$$D = C + 1 = (13)_{10}$$

$$E = D + 1 = (14)_{10}$$

$$F = E + 1 = (15)_{10}$$

16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	
1	0	1	0	1	1	0	1	
1×16^7	0×16^6	1×16^5	0×16^4	1×16^3	1×16^2	0×16^1	1×16^0	Σ
								269,488,385

16^7	16^6	16^5	16^4	16^3	16^2	16^1	16^0	
1	0	1	0	1	1	0	1	
1×16^7	0×16^6	1×16^5	0×16^4	1×16^3	1×16^2	0×16^1	1×16^0	
								269,488,385
10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	
1	0	1	0	1	1	0	1	
1×10^7	0×10^6	1×10^5	0×10^4	1×10^3	1×10^2	0×10^1	1×10^0	
								10,101,101
8^7	8^6	8^5	8^4	8^3	8^2	8^1	8^0	
1	0	1	0	1	1	0	1	
1×8^7	0×8^6	1×8^5	0×8^4	1×8^3	1×8^2	0×8^1	1×8^0	
								2,130,497
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	
1	0	1	0	1	1	0	1	
1×2^7	0×2^6	1×2^5	0×2^4	1×2^3	1×2^2	0×2^1	1×2^0	
								173



LET'S COUNT IN BASE-16

$(\begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix} \begin{smallmatrix} \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet & \bullet \end{smallmatrix})_{16}$

A cosmic background image featuring a dense field of galaxies in various colors (blue, orange, white) against a black space. A solid black horizontal band runs across the middle of the image, serving as a backdrop for the text.

BASE-64 | RADIX-64

(A,B,C, ...,Z, a,b,c,...,z,0,1,2,...,9,+ ,/)₆₄



BASE-64 | RADIX-64
(A,B,C, ...,Z, a,b,c,...,z,0,1,2,...,9,+ ,/)₆₄

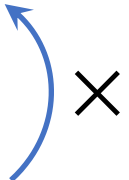
1992: RFC 1341

MIME (MULTIPURPOSE INTERNET MAIL EXTENSIONS)


Mechanisms For Specifying And Describing The Format Of Internet Message Bodies


Digit	Value		Digit	Value		Digit	Value		Digit	Value
A	0		Q	16		g	32		w	48
B	1		R	17		h	33		x	49
C	2		S	18		i	34		y	50
D	3		T	19		j	35		z	51
E	4		U	20		k	36		0	52
F	5		V	21		l	37		1	53
G	6		W	22		m	38		2	54
H	7	→	X	23	→	n	39	→	3	55
I	8		Y	24		o	40		4	56
J	9		Z	25		p	41		5	57
K	10		a	26		q	42		6	58
L	11		b	27		r	43		7	59
M	12		c	28		s	44		8	60
N	13		d	29		t	45		9	61
O	14		e	30		u	46		+	62
P	15		f	31		v	47		/	63

3	a	A	/	d	1	H	+	
---	---	---	---	---	---	---	---	--

64^7	64^6	64^5	64^4	64^3	64^2	64^1	64^0	
3	a	A	/	d	1	H	+	
								Σ

Digit	Value		Digit	Value		Digit	Value		Digit	Value
A	0	→	Q	16	→	g	32	→	w	48
B	1		R	17		h	33		x	49
C	2		S	18		i	34		y	50
D	3		T	19		j	35		z	51
E	4		U	20		k	36		0	52
F	5		V	21		l	37		1	53
G	6		W	22		m	38		2	54
H	7		X	23		n	39		3	55
I	8		Y	24		o	40		4	56
J	9		Z	25		p	41		5	57
K	10		a	26		q	42		6	58
L	11		b	27		r	43		7	59
M	12		c	28		s	44		8	60
N	13		d	29		t	45		9	61
O	14		e	30		u	46		+	62
P	15		f	31		v	47		/	63

64^7	64^6	64^5	64^4	64^3	64^2	64^1	64^0	
3	a	A	/	d	1	H	+	
55 $\times 64^7$	26 $\times 64^6$	0 $\times 64^5$	63 $\times 64^4$	29 $\times 64^3$	53 $\times 64^2$	7 $\times 64^1$	62 $\times 64^0$	Σ

64^7	64^6	64^5	64^4	64^3	64^2	64^1	64^0	
3	a	A	/	d	1	H	+	
55 $\times 64^7$	26 $\times 64^6$	0 $\times 64^5$	63 $\times 64^4$	29 $\times 64^3$	53 $\times 64^2$	7 $\times 64^1$	62 $\times 64^0$	Σ
								243,680,329, 290,238

Increment by 1 → Increment by AAAB

+ Base-64				a	+	Z	/
				A	A	A	B



+ Base-64				a ₌₂₆	+ ₌₆₂	Z ₌₂₅	/ ₌₆₃
				A ₌₀	A ₌₀	A ₌₀	B ₌₁

						B ₌₁	
+ Base-64				a ₌₂₆	+ ₌₆₂	Z ₌₂₅	/ ₌₆₃
				A ₌₀	A ₌₀	A ₌₀	B ₌₁
							A ₌₀

$$\frac{64}{64} = 1 \text{ } r \text{ } 0$$

$$= B \text{ } r \text{ } A$$

						B ₌₁	
+ Base-64				a ₌₂₆	+ ₌₆₂	Z ₌₂₅	/ ₌₆₃
				A ₌₀	A ₌₀	A ₌₀	B ₌₁
				a	+	a ₌₂₆	A ₌₀



RADIX-R NUMBER SYSTEM

aka. Base-r Number System

Hosseini's number system is not a Radix-r number system!

Let $(N)_r$ be a radix- r (base- r) number in a positional weighting number system, then

$$(N)_r = (d_{n-1} r^{n-1} + d_{n-2} r^{n-2} + \dots + d_i r^i + \dots + d_2 r^2 + d_1 r^1 + d_0 r^0)_{10}$$

where:

r = radix (base)

d_i = digit at position i , $0 \leq d_i \leq r - 1$

r^i = weight (significance) of position i

n = number of digits in N

Let $(N)_r$ be a radix- r (base- r) number in a positional weighting number system, then

$$(N)_r = (d_{n-1} r^{n-1} + d_{n-2} r^{n-2} + \dots + d_i r^i + \dots + d_2 r^2 + d_1 r^1 + d_0 r^0)_{10}$$

where:

r = radix (base)

d_i = digit at position i , $0 \leq d_i \leq r - 1$

r^i = weight (significance) of position i

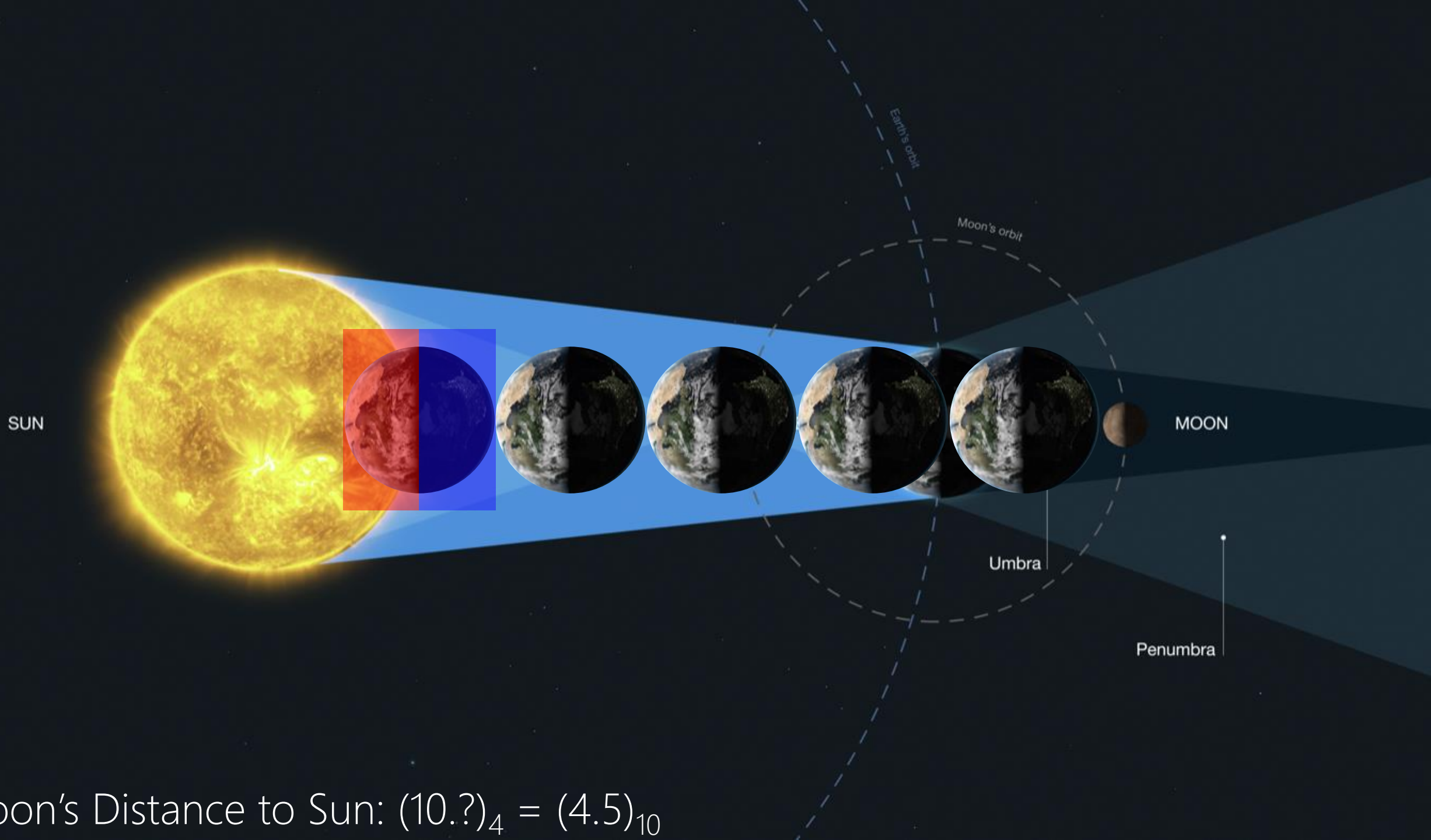
n = number of digits in N

Let $(N)_r$ be a radix- r (base- r) number in a positional weighting number system, then

Min	$= (0_{n-1}0_{n-2} \cdots 0_10_0)_r$	$= (0)_{10}$
Max	$= ((r-1)_{n-1}(r-1)_{n-2} \cdots (r-1)_1(r-1)_0)_r$	$= (r^n-1)_{10}$
Unit	$= (0_{n-1}0_{n-2} \cdots 0_11_0)_r$	$= (1)_{10}$

where:

- r = radix (base)
- r^i = weight of position i
- n = number of digits in N



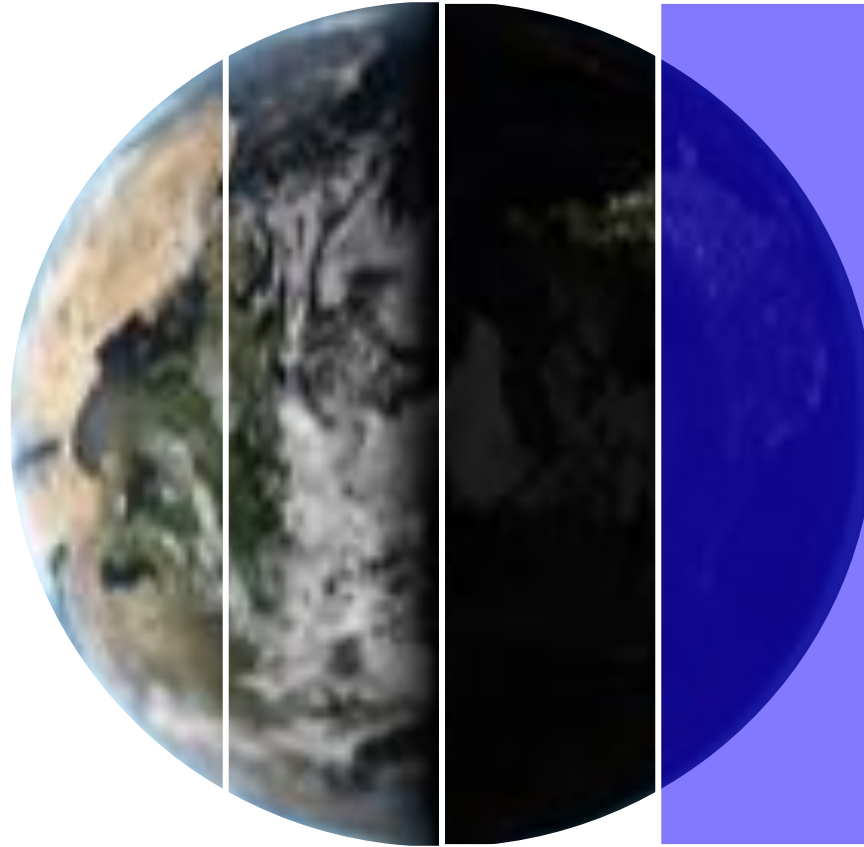
Moon's Distance to Sun: $(10.?)_4 = (4.5)_{10}$

A cosmic background image featuring a dense field of galaxies in various colors (yellow, orange, blue, red) against a black space. Two horizontal blue lines are positioned above and below the central text.

FRACTION

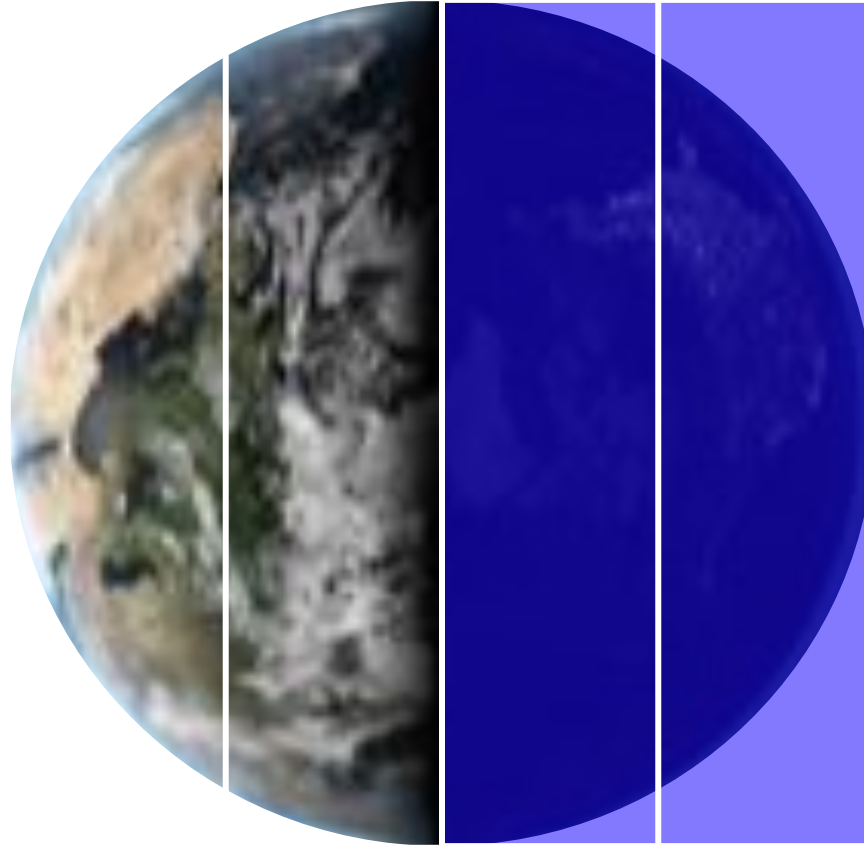


1 Earth

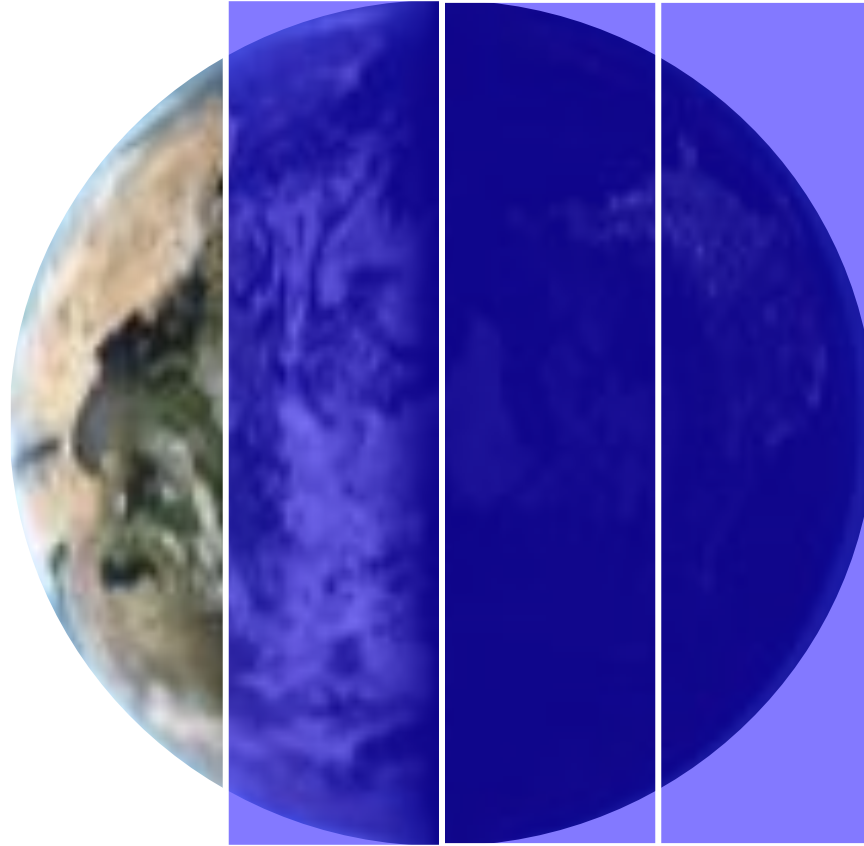


Fraction Point

Radix-4 (Base-4) = $1/4$ Earth = 4^{-1} Earth = $(.1)_4$



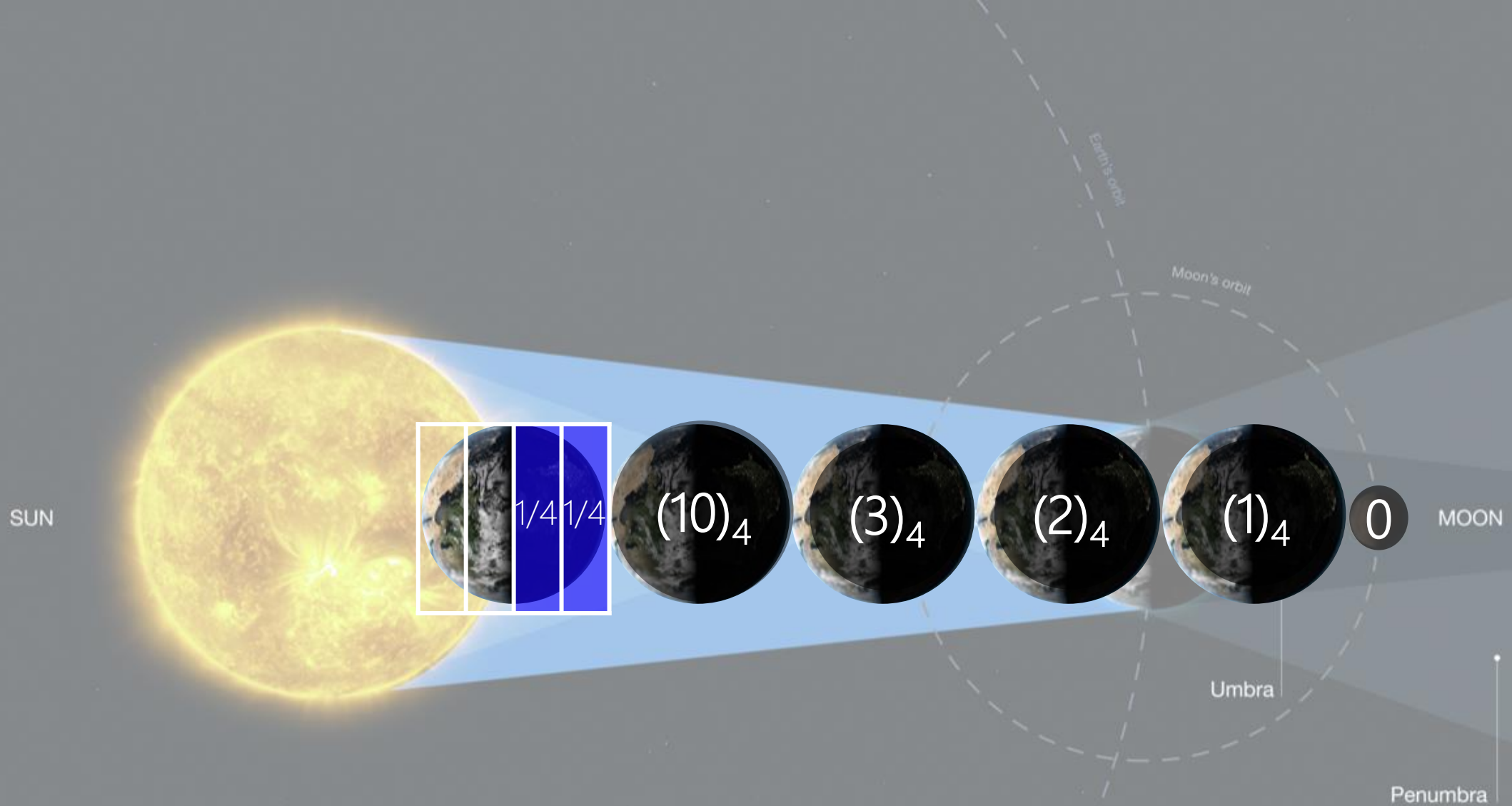
Radix-4 (Base-4) = $2 \times 1/4 \text{ Earth} = 2 \times 4^{-1} \text{ Earth} = (.2)_4$



Radix-4 (Base-4) = $3 \times 1/4 \text{ Earth} = 3 \times 4^{-1} \text{ Earth} = (.3)_4$

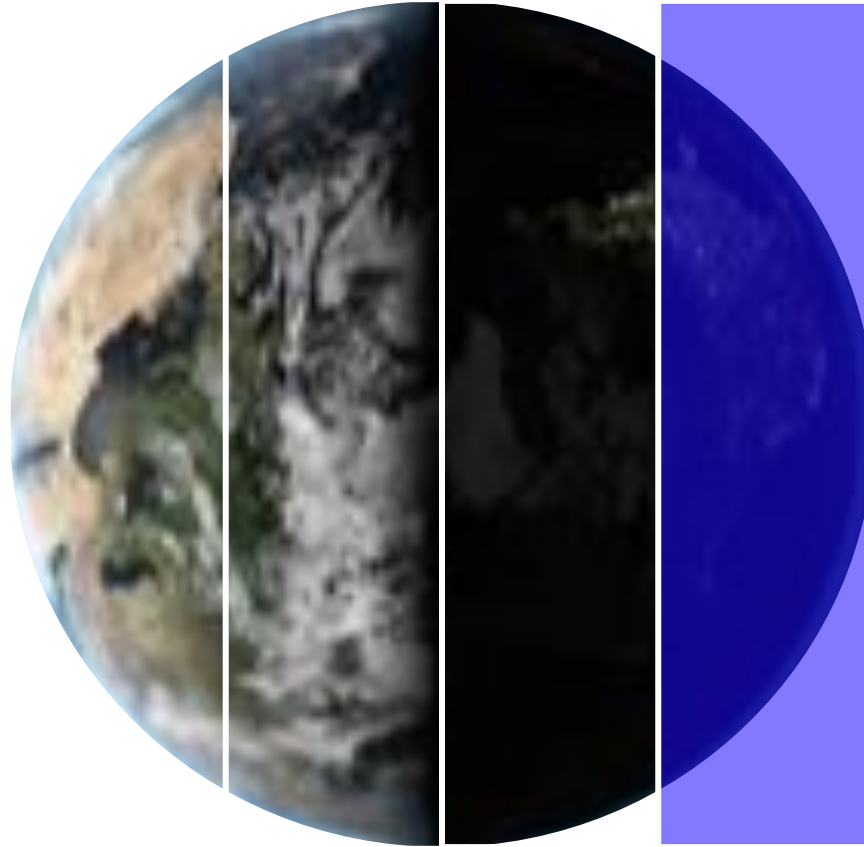


Radix-4 (Base-4) = $4 \times 1/4 \text{ Earth} = 4 \times 4^{-1} \text{ Earth} = (1)_4$

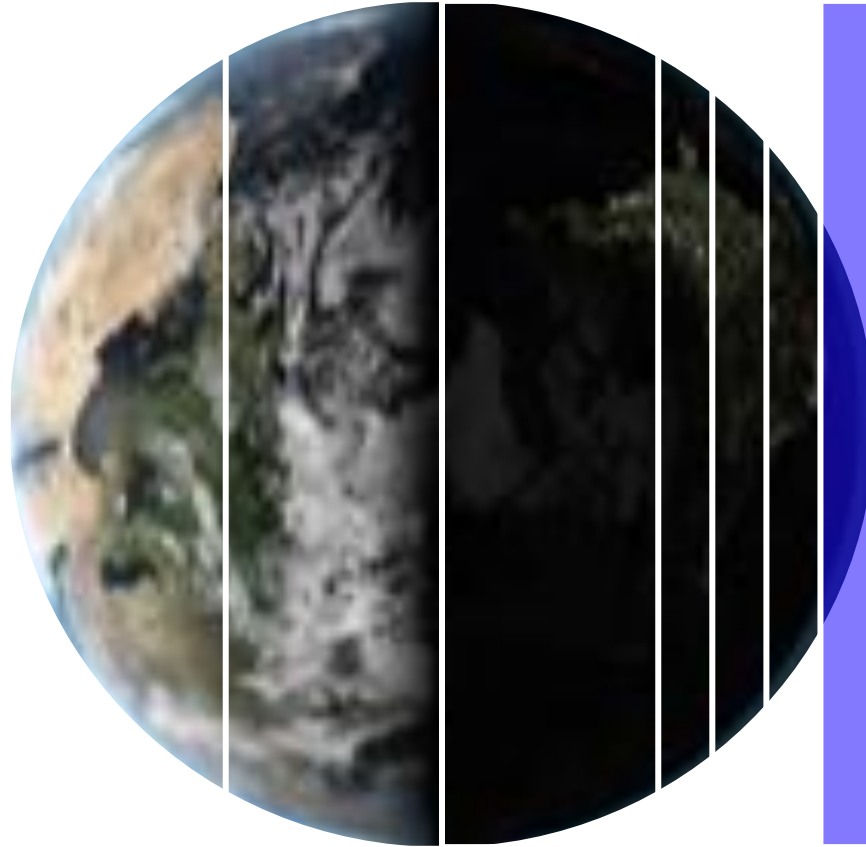


Moon's Distance to Sun in Radix-4: $(10.2)_4$

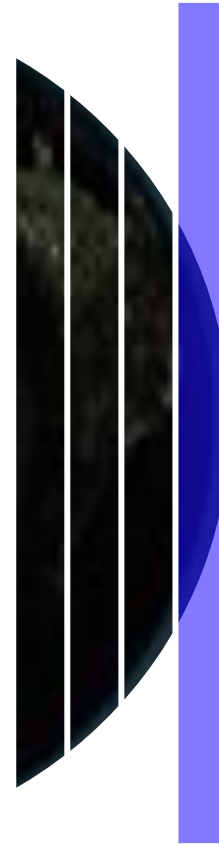
MORE PRECISION



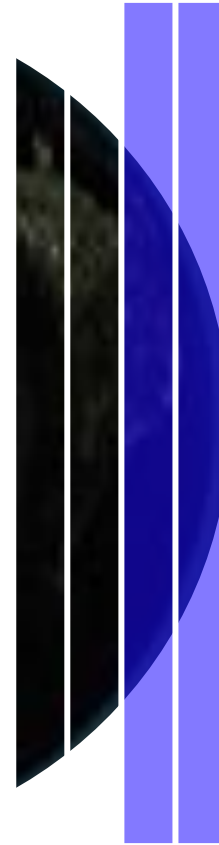
Radix-4 (Base-4) = $1/4$ Earth = 4^{-1} Earth = $(.1)_4$



Radix-4 (Base-4) = $(1/4)/4$ Earth = $1/16$ Earth = 4^{-2} Earth



Radix-4 (Base-4) = $1/16 = 4^{-2}$ Earth = $(.01)_4$



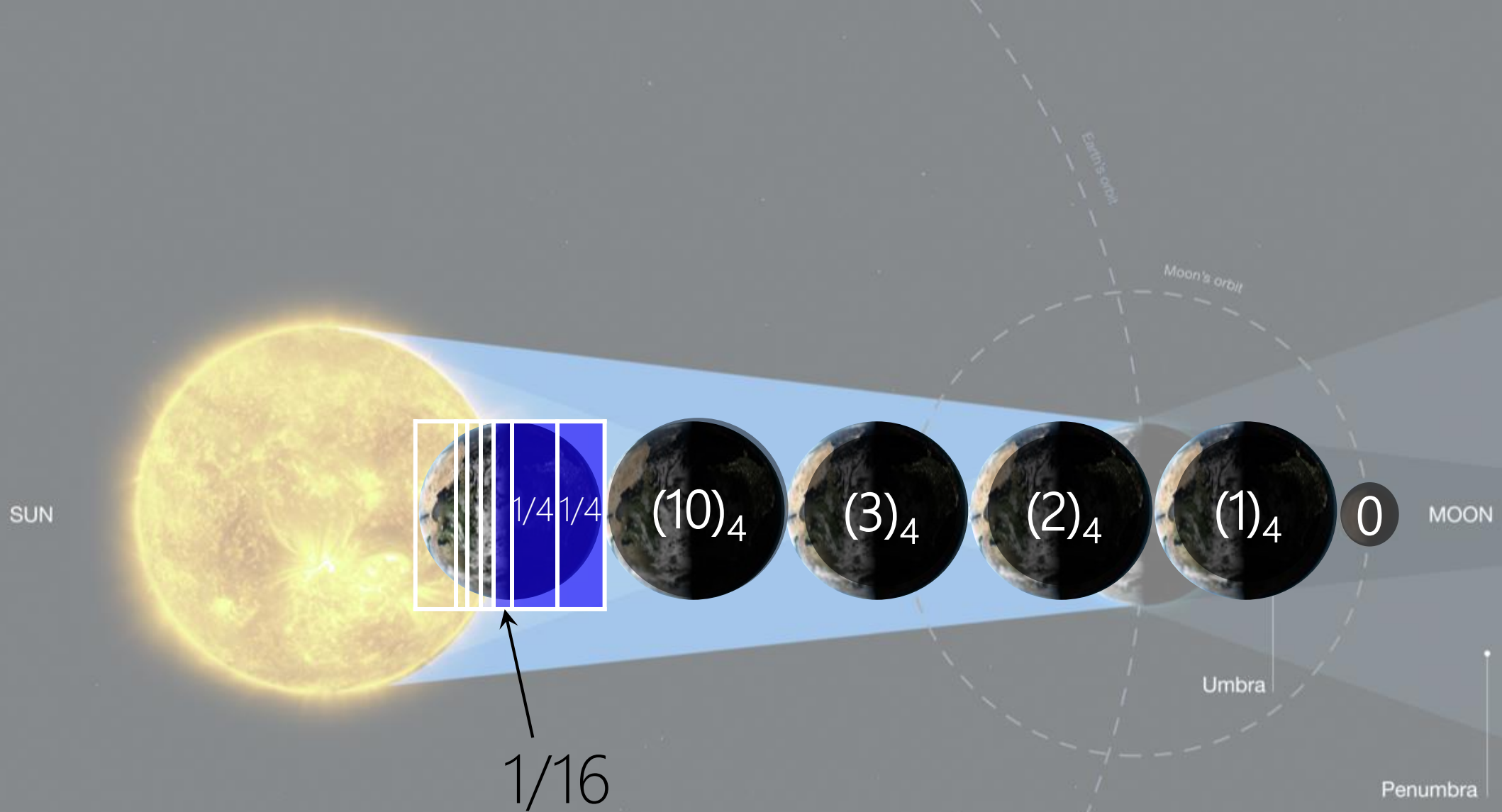
$$\text{Radix-4 (Base-4)} = 2 \times 1/16 = 2 \times 4^{-2} \text{ Earth} = (.02)_4$$



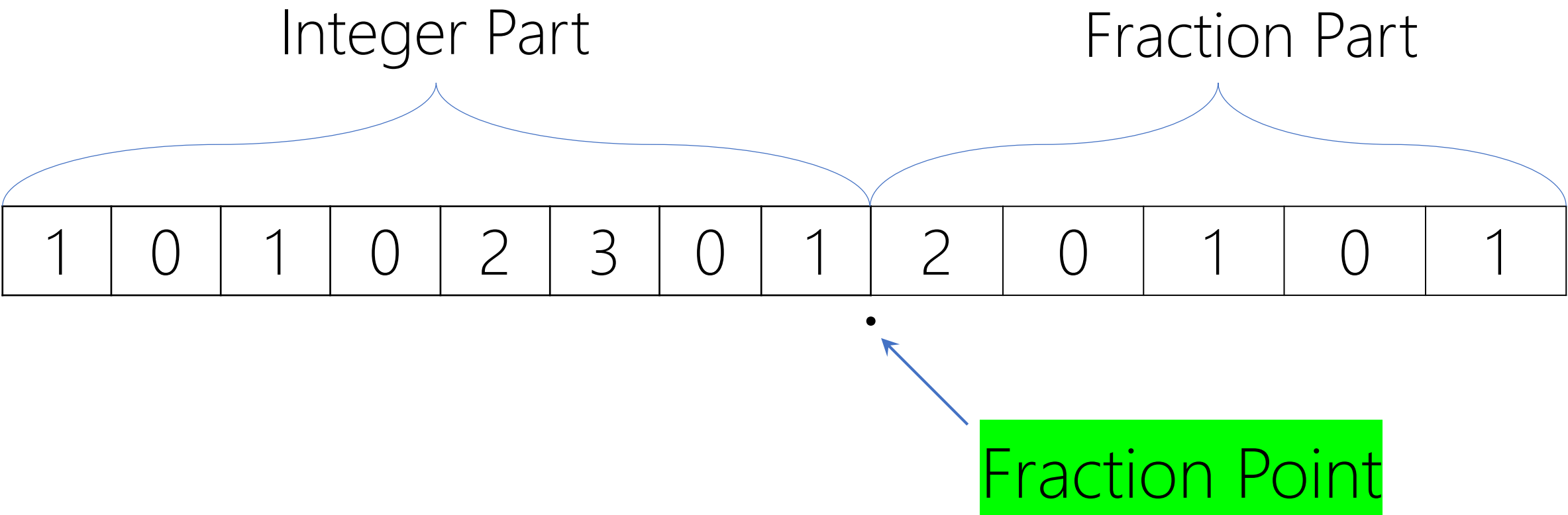
$$\text{Radix-4 (Base-4)} = 3 \times 1/16 = 3 \times 4^{-2} \text{ Earth} = (.03)_4$$



$$\text{Radix-4 (Base-4)} = 4 \times 1/16 = 4 \times 4^{-2} \text{ Earth} = (.1)_4$$



Moon's Distance to Sun in Radix-4: $(10.21)_4$



Integer Part

Fraction Part

4^7	4^6	4^5	4^4	4^3	4^2	4^1	4^0		4^{-1}	4^{-2}	4^{-3}	4^{-4}	4^{-5}
1	0	1	0	2	3	0	1	.	2	0	1	0	1

Integer Part

Fraction Part

4^7	4^6	4^5	4^4	4^3	4^2	4^1	4^0	\times	4^{-1}	4^{-2}	4^{-3}	4^{-4}	4^{-5}
1	0	1	0	2	3	0	1	.	2	0	1	0	1
$\frac{1}{\times 16,384}$	0	$\frac{1}{\times 1,024}$	0	$\frac{2}{\times 64}$	$\frac{3}{\times 16}$	0	1	Σ	$\frac{2}{4}$	0	$\frac{1}{64}$	0	$\frac{1}{1,024}$

Integer Part

Fraction Part

4^7	4^6	4^5	4^4	4^3	4^2	4^1	4^0	\times	4^{-1}	4^{-2}	4^{-3}	4^{-4}	4^{-5}
1	0	1	0	2	3	0	1	.	2	0	1	0	1
1 $\times 16,384$	0	1 $\times 1,024$	0	2 $\times 64$	3 $\times 16$	0	1	Σ	$\frac{2}{4}$	0	$\frac{1}{64}$	0	$\frac{1}{1,024}$
				17,584				.					

Integer Part

Fraction Part

4^7	4^6	4^5	4^4	4^3	4^2	4^1	4^0	\times	4^{-1}	4^{-2}	4^{-3}	4^{-4}	4^{-5}
1	0	1	0	2	3	0	1	.	2	0	1	0	1
1 $\times 16,384$	0	1 $\times 1,024$	0	2 $\times 64$	3 $\times 16$	0	1	Σ	$\frac{2}{4}$	0	$\frac{1}{64}$	0	$\frac{1}{1,024}$
				17,584				.	5166015625				

Let $(N)_r$ be a radix- r (base- r) number in a positional weighting number system, then

$$(N)_r = (d_{n-1}r^{n-1} + \dots + d_0r^0 . d_{-1}r^{-1} + d_{-2}r^{-2} + \dots + d_{-m}r^{-m})_{10}$$

where:

r = radix (base)

d_i = digit at position i , $0 \leq d_i \leq r - 1$

r^i = weight of position i

n = number of digits in integer part of N

m = number of digits in fraction part of N



Fraction Point

Let $(N)_r$ be a radix- r (base- r) number in a positional weighting number system, then

$$\begin{aligned}\text{Min} &= (0_{n-1} \cdots 0_1 0_0 . 0_{-1} 0_{-2} \cdots 0_{-m-1} 0_{-m})_r = (0 . 0)_{10} \\ \text{Max} &= ((r-1)_{n-1} \cdots (r-1)_0 . (r-1)_{-1} (r-1)_{-2} \cdots (r-1)_{-m-1} (r-1)_{-m})_r = (r^n - 1 . ?)_{10} \\ \text{Unit} &= (0_{n-1} \cdots 0_1 0_0 . 0_{-1} 0_{-2} \cdots 0_{-m-1} 1_{-m})_r = (r^{-m})_{10}\end{aligned}$$

where:

r = radix (base)

r^i = weight of position i

n = number of digits in integer part of N

m = number of digits in fraction part of N

Lecture Assignment

A deep-field astronomical image showing a vast field of galaxies in various colors (blue, orange, white) against a black background. Two horizontal blue lines frame the central text.

PRACTICE RADIX-2

Radix-2								
Integer (n=4)					Fraction (m=3)			Radix-10
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	$1 \cdot 2^{-3} = 1/8 = 0.125$
0	0	0	0	.	0	1	0	$1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/4 = 0.25$
0	0	0	0	.	0	1	1	$1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/4 + 1/8 = 3/8 = 0.375$
0	0	0	0	.	1	0	0	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 = 0.5$
0	0	0	0	.	1	0	1	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/8 = 5/8 = 0.625$
0	0	0	0	.	1	1	0	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 + 1/4 = 3/4 = 0.75$
0	0	0	0	.	1	1	1	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/4 + 1/8 = 0.875$
0	0	0	1	.	0	0	0	$1 \cdot 2^0 + 0 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1$
0	0	0	1	.	0	0	1	1.125
0	0	0	1	.	0	1	0	1.25
0	0	0	1	.	0	1	1	1.375
0	0	0	1	.	1	0	0	1.5
0	0	0	1	.	1	0	1	1.625
0	0	0	1	.	1	1	0	1.75
0	0	0	1	.	1	1	1	1.875
0	0	1	0	.	0	0	0	2

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

What is the max in this system with these spaces?

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

What is the **max** in this system with these spaces?
 $(1111.111)_2 = (15.875)_{10}$

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1/2 = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?

Radix-2								
Integer (n=4)					Fraction (m=3)			Radix-10
2^3	2^2	2^1	2^0	.	2^{-1}	2^{-2}	2^{-3}	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	$1 \cdot 2^{-3} = 1/8 = 0.125$
0	0	0	0	.	0	1	0	$1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/4 = 0.25$
0	0	0	0	.	0	1	1	$1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/4 + 1/8 = 3/8 = 0.375$
0	0	0	0	.	1	0	0	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 = 0.5$
0	0	0	0	.	1	0	1	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/8 = 5/8 = 0.625$
0	0	0	0	.	1	1	0	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 + 1/4 = 3/4 = 0.75$
0	0	0	0	.	1	1	1	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/4 + 1/8 = 0.875$
0	0	0	1	.	0	0	0	$1 \cdot 2^0 + 0 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1$
0	0	0	1	.	0	0	1	1.125
0	0	0	1	.	0	1	0	1.25
0	0	0	1	.	0	1	1	1.375
0	0	0	1	.	1	0	0	1.5
0	0	0	1	.	1	0	1	1.625
0	0	0	1	.	1	1	0	1.75
0	0	0	1	.	1	1	1	1.875
0	0	1	0	.	0	0	0	2

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?

A. More precision.

Radix-2								
Integer (n=4)					Fraction (m=3)			Radix-10
2^3	2^2	2^1	2^0	.	2^{-1}	2^{-2}	2^{-3}	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	$1 \cdot 2^{-3} = 1/8 = 0.125$
0	0	0	0	.	0	1	0	$1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/4 = 0.25$
0	0	0	0	.	0	1	1	$1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/4 + 1/8 = 3/8 = 0.375$
0	0	0	0	.	1	0	0	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 = 0.5$
0	0	0	0	.	1	0	1	$1 \cdot 2^{-1} + 0 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/8 = 5/8 = 0.625$
0	0	0	0	.	1	1	0	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1/2 + 1/4 = 3/4 = 0.75$
0	0	0	0	.	1	1	1	$1 \cdot 2^{-1} + 1 \cdot 2^{-2} + 1 \cdot 2^{-3} = 1/2 + 1/4 + 1/8 = 0.875$
0	0	0	1	.	0	0	0	$1 \cdot 2^0 + 0 \cdot 2^{-1} + 0 \cdot 2^{-2} + 0 \cdot 2^{-3} = 1$
0	0	0	1	.	0	0	1	1.125
0	0	0	1	.	0	1	0	1.25
0	0	0	1	.	0	1	1	1.375
0	0	0	1	.	1	0	0	1.5
0	0	0	1	.	1	0	1	1.625
0	0	0	1	.	1	1	0	1.75
0	0	0	1	.	1	1	1	1.875
0	0	1	0	.	0	0	0	2

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?

A. More precision.

A. More fraction positions.

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

- Solution?
- A. More precision.
 - A. More fraction positions.
 - A. More in m!

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

- Solution?
- A. More precision.
 - A. More fraction positions.
 - A. More in m! **How much?**

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?

B. Find the closest number

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?

B. Find the closest number
 $(1.000)_2 = (1)_{10} \Rightarrow \text{Error} = 0.02$
 $(1.001)_2 = (1.125)_{10} \Rightarrow \text{Error} = 0.105$

Radix-2									Radix-10
Integer (n=4)					Fraction (m=3)				
2 ³	2 ²	2 ¹	2 ⁰	.	2 ⁻¹	2 ⁻²	2 ⁻³		
0	0	0	0	.	0	0	0	0	
0	0	0	0	.	0	0	1	1*2 ⁻³ = 1/8 = 0.125	
0	0	0	0	.	0	1	0	1*2 ⁻² + 0*2 ⁻³ = 1/4 = 0.25	
0	0	0	0	.	0	1	1	1*2 ⁻² + 1*2 ⁻³ = 1/4 + 1/8 = 3/8 = 0.375	
0	0	0	0	.	1	0	0	1*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = ½ = 0.5	
0	0	0	0	.	1	0	1	1*2 ⁻¹ + 0*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/8 = 5/8 = 0.625	
0	0	0	0	.	1	1	0	1*2 ⁻¹ + 1*2 ⁻² + 0*2 ⁻³ = 1/2 + 1/4 = 3/4 = 0.75	
0	0	0	0	.	1	1	1	1*2 ⁻¹ + 1*2 ⁻² + 1*2 ⁻³ = 1/2 + 1/4 + 1/8 = 0.875	
0	0	0	1	.	0	0	0	1*2 ⁰ + 0*2 ⁻¹ + 0*2 ⁻² + 0*2 ⁻³ = 1	
0	0	0	1	.	0	0	1	1.125	
0	0	0	1	.	0	1	0	1.25	
0	0	0	1	.	0	1	1	1.375	
0	0	0	1	.	1	0	0	1.5	
0	0	0	1	.	1	0	1	1.625	
0	0	0	1	.	1	1	0	1.75	
0	0	0	1	.	1	1	1	1.875	
0	0	1	0	.	0	0	0	2	

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! The numbers in this system increments by 0.125 unit.

Solution?
B. Find the closest number
 $(1.000)_2 = (1)_{10} \Rightarrow \text{Error} = 0.02$
 $(1.001)_2 = (1.125)_{10} \Rightarrow \text{Error} = 0.105$

A deep-field astronomical image showing a vast field of galaxies in various colors (blue, orange, white) against a black background. Two horizontal blue lines frame the central text.

PRACTICE RADIX-4

Radix-4								
Integer (n=4)					Fraction (m=3)			Radix-10
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
...								
3	3	3	3	.	3	3	0	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 0*4 ⁻³ = ?
3	3	3	3	.	3	3	1	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 1*4 ⁻³ = ?
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Radix-4								Radix-10
Integer (n=4)				Fraction (m=3)				
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
...								
3	3	3	3	.	3	3	0	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 0*4 ⁻³ = ?
3	3	3	3	.	3	3	1	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 1*4 ⁻³ = ?
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

Radix-4								Radix-10
Integer (n=4)				Fraction (m=3)				
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
...								
3	3	3	3	.	3	3	0	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 0*4 ⁻³ = ?
3	3	3	3	.	3	3	1	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 1*4 ⁻³ = ?
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! Why?

Radix-4								Radix-10
Integer (n=4)				Fraction (m=3)				
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
...								
3	3	3	3	.	3	3	0	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 0*4 ⁻³ = ?
3	3	3	3	.	3	3	1	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 1*4 ⁻³ = ?
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! Why?

Solution:

A. More in m

B. Find the closest number

Radix-4								
Integer (n=4)					Fraction (m=3)			Radix-10
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
0	0	0	1	.	0	0	1	1.015625
0	0	0	1	.	0	0	2	1.03125
...								
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! Why?

Solution:

A. More in m

B. Find the closest number

$(1.001)_4 = (1.015625)_{10} \Rightarrow \text{Error} = 0.004375$

$(1.002)_4 = (1.03125)_{10} \Rightarrow \text{Error} = 0.01125$

Radix-4								
Integer (n=4)					Fraction (m=3)			Radix-10
4 ³	4 ²	4 ¹	4 ⁰	.	4 ⁻¹	4 ⁻²	4 ⁻³	
0	0	0	0	.	0	0	0	0
0	0	0	0	.	0	0	1	1*4 ⁻³ = 1/64 = 0.015625
0	0	0	0	.	0	0	2	2*4 ⁻³ = 2/64 = 0.03125
0	0	0	0	.	0	0	3	3*4 ⁻³ = 3/64 = 0.046875
0	0	0	0	.	0	1	0	1*4 ⁻² + 0*4 ⁻² = 1/16 = 0.0625
0	0	0	0	.	0	1	1	1*4 ⁻² + 1*4 ⁻² = 1/16 + 1/64 = 0.078125
0	0	0	0	.	0	1	2	1*4 ⁻² + 2*4 ⁻² = 1/16 + 2/64 = 0.09375
0	0	0	0	.	0	1	3	1*4 ⁻² + 3*4 ⁻² = 1/16 + 3/64 = 0.109375
0	0	0	0	.	0	2	0	2*4 ⁻² + 0*4 ⁻² = 2/16 = 0.125
...								
0	0	0	0	.	3	3	3	3*4 ⁻¹ + 3*4 ⁻² + 3*4 ⁻³ = 0.984375
0	0	0	1	.	0	0	0	1
0	0	0	1	.	0	0	1	1.015625
0	0	0	1	.	0	0	2	1.03125
...								
3	3	3	3	.	3	3	2	3*4 ³ + 3*4 ² + 3*4 ¹ +3*4 ⁰ +3*4 ⁻¹ + 3*4 ⁻² + 2*4 ⁻³ = ?
3	3	3	3	.	3	3	3	255.984375

Is it possible to show the number $(1.02)_{10}$ in this system with these spaces?

No! Why?

Solution:

A. More in m

B. Find the closest number

$(1.001)_4 = (1.015625)_{10} \Rightarrow \text{Error} = 0.004375$

$(1.002)_4 = (1.03125)_{10} \Rightarrow \text{Error} = 0.01125$

A cosmic background image featuring a dense field of galaxies in various colors (blue, orange, white) against a black space. Two horizontal blue lines are positioned above and below the text.

PRACTICE RADIX-[8,10,16]

At Home