

bunch

unpackaged

unindexed

set

packaged

unindexed

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string

<https://powcoder.com>

unpackaged

indexed

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list

packaged

indexed

Bunch Theory

Bunches can be used to represent collections.

1, 3, 7

$\top, \perp, 5, "a"$

2

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Any number, character, binary, or set is an **elementary bunch**, or **element**.

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A, B

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Union

$A ' B$

intersection

$|A|$

size, cardinality (number)

$A: B$

inclusion (binary)

Bunch Theory

$$1, 3, 7 = 3, 1, 7, 1$$

$$\phi 2 = 1$$

$$\phi(1, 3, 7) = 3 = \phi(3, 1, 7, 1)$$

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$$2: 0, 2, 5, 9$$

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$$2: 2$$

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$$2, 9: 0, 2, 5, 9$$

Bunch Theory

axioms

$$x: y = x=y \quad \text{elementary axiom}$$

$$x: A,B = x: A \vee x: B \quad \text{compound axiom}$$

$$A,A = A \quad \text{idempotence}$$

$$A,B = B,A \quad \text{symmetry}$$

$$A,(B,C) = (A,B),C \quad \text{associativity}$$

$$A'A = A \quad \text{idempotence}$$

$$A'B = B'A \quad \text{symmetry}$$

$$A'(B'C) = (A'B)'C \quad \text{associativity}$$

$$A,B: C = A: C \wedge B: C \quad \text{antidistributivity}$$

$$A: B'C = A: B \wedge A: C \quad \text{distributivity}$$

$$A: A,B \quad \text{generalization}$$

$$A'B: A \quad \text{specialization}$$

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Bunch Theory

axioms

$$A: A \quad \text{reflexivity}$$

$$A: B \wedge B: A = A=B \quad \text{antisymmetry}$$

$$A: B \wedge B: C \Rightarrow A: C \quad \text{transitivity}$$

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size

$$\varphi(A,B) + \varphi(A' B) = \varphi^A + \varphi^B \quad \text{size}$$

$$\neg x: A \Rightarrow \varphi(A' x) = 0 \quad \text{size}$$

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$$A: B \Rightarrow \varphi A \leq \varphi B \quad \text{size}$$

Bunch Theory

laws

$$A,(A \cdot B) = A \quad \text{absorption}$$

$$A \cdot (A,B) = A \quad \text{absorption}$$

$$\begin{array}{l} A:B \Rightarrow C,A;C,B \\ A:B \Rightarrow C \cdot A;C \cdot B \end{array} \quad \begin{array}{l} \text{monotonicity} \\ \text{monotonicity} \end{array}$$

$$A:B = A,B = B \underset{A=A \cdot B}{=} \text{https://powcoder.com} \quad \text{inclusion}$$

$$A,(B,C) = (A,B),(A,C) \quad \text{distributivity}$$

$$A,(B \cdot C) = (A,B) \cdot (A,C) \quad \text{distributivity}$$

$$A \cdot (B,C) = (A \cdot B), (A \cdot C) \quad \text{distributivity}$$

$$A \cdot (B \cdot C) = (A \cdot B) \cdot (A \cdot C) \quad \text{distributivity}$$

$$A:B \wedge C:D \Rightarrow A,C:B,D \quad \text{conflation}$$

$$A:B \wedge C:D \Rightarrow A \cdot C:B \cdot D \quad \text{conflation}$$

Bunch Theory

<i>null</i>		the empty bunch
<i>bin</i>	= \top, \perp	the binary values
<i>nat</i>	= $0, 1, 2, \dots$	the natural numbers
<i>int</i>	= $\dots, -2, -1, 0, 1, 2, \dots$	the integer numbers
<i>rat</i>	= $\dots, -1, 0, 2/3, \dots$	the rational numbers
<i>real</i>	= $\dots, 2^{\text{1/2}}, \dots$	the real numbers
<i>xnat</i>	= $0, 1, 2, \dots, \infty$	the extended natural numbers
<i>xint</i>	= $-\infty, \dots, -2, -1, 0, 1, 2, \dots, \infty$	the extended integer numbers
<i>xrat</i>	= $-\infty, \dots, -1, 0, 2/3, \dots, \infty$	the extended rational numbers
<i>xreal</i>	= $-\infty, \dots, \infty$	the extended real numbers
<i>char</i>	= $\dots, "a", "A", \dots$	the character values

Bunch Theory

$$i : x .. y = x \leq i < y$$

$$\phi(x .. y) = y - x$$

$$0 .. 3 = 0, 1, 2$$

$$0 .. 2 = 0, 1$$

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$$0 .. 1 = 0$$

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$$0 .. 0 = null$$

$$0 .. \infty = nat$$

Bunch Theory

distribution

$$-(1, 3, 7) = -1, -3, -7$$

$$(1, 2) + (10, 20) = 11, 12, 21, 22$$

$$(1, 2) + 10 = 11, 12$$

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$$1 + 10 = 11$$

$$null + 10 = null \quad \text{https://powcoder.com}$$

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$$nat + 2 = 2, 3, 4, 5, 6, \dots$$

$$nat \times 2 = 0, 2, 4, 6, 8, \dots$$

$$nat^2 = 0, 1, 4, 9, 16, \dots$$

$$2^{nat} = 1, 2, 4, 8, 16, \dots$$

Set Theory

provides nested structure (things within things)

$\{A\}$

“set containing A ”

$\sim S$

“contents of S ”

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$\{\{1, 3, 7\}, 8\}$

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$\{null\}$

Add WeChat the empty set powcoder

$\{nat\}$

the set of natural numbers

$\{0, 1, 2\} = \{0..3\}$

$\sim\{1, 3, 7\} = 1, 3, 7$

contents

$\$1, 3, 7\} = 3$

size, cardinality

$\#(0, 1) = \{null\}, \{0\}, \{1\}, \{0, 1\}$

power

Set Theory

axioms

$$\{\sim S\} = S$$

$$\sim\{A\} = A$$

$$\{A\} \neq A$$

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$$\$A = \emptyset$$

$$A \in \{B\} = A : B$$

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$$\{A\} \subseteq \{B\} = A : B$$

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$$\{A\} : \#B = A : B$$

$$\{A\} \cup \{B\} = \{A, B\}$$

$$\{A\} \cap \{B\} = \{A \cdot B\}$$

$$\{A\} = \{B\} = A = B$$

String Theory

Strings are indexed sequences.

<i>nil</i>	the empty string
3	a one-item string
3; 5; 7; 9	a four-item string

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$$(3; 5; 7; 9)_2 = 7$$

At index n , the number of items processed is n
the next item to be processed is item $n+1$

Zero

John Allen Paulos:

Innumeracy: Mathematical Illiteracy and its Consequences, Hill and Wang, 1988

Beyond Numeracy, Knopf, 1991

0.10¢ \$2.93.9

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There are a number of things to discuss. (But not zero things to discuss.)

Subtract line A from line B; if there is no difference, write "nil".

keyboard, telephone: 1 2 3 4 5 6 7 8 9 0

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 STEP 6 <p>Did you leave anyone out of Step 5 because you were not sure the person should be listed?</p> <p>00.</p> <p>For example: other relatives living here; a student away at school; a lodger who also has another home; live-in help; or a member of this household who is away in an institution.</p>	<p><input type="radio"/> No</p> <p>01 <input checked="" type="radio"/> Yes — Print the name of each person left out and the reason.</p> <table border="1" style="width: 100%;"> <tr> <td>Name</td> </tr> <tr> <td>Reason</td> </tr> <tr> <td> </td> </tr> </table> <table border="1" style="width: 100%;"> <tr> <td>Name</td> </tr> <tr> <td>Reason</td> </tr> <tr> <td> </td> </tr> </table> <table border="1" style="width: 100%;"> <tr> <td>Name</td> </tr> <tr> <td>Reason</td> </tr> <tr> <td> </td> </tr> </table> <p>If you need more space, use the "Comments" section on page 28.</p>	Name	Reason		Name	Reason		Name	Reason	
Name										
Reason										
Name										
Reason										
Name										
Reason										
<p></p> <p>STEP 7 How many persons who have a usual home somewhere else in Canada stayed here overnight between June 3 and 4, 1991?</p> <p><input type="radio"/> None</p> <p>02 <input checked="" type="checkbox"/> Number of persons</p> <p></p> <p>Add WeChat powcoder</p>										
<p></p> <p>STEP 8 Does anyone in this household OPERATE a farm, ranch or other agricultural holding?</p> <p>Other agricultural holdings include, for example: feedlots; greenhouses; mushroom houses; nurseries; fur farms; and beekeeping, sod, berry and maple syrup operations.</p> <p>03 <input type="radio"/> No</p> <p>04 <input type="radio"/> Yes</p>										
<p></p> <p>STEP 9 Turn the page and copy the names from Step 5 into the spaces across the top of the page. Then continue with the questionnaire.</p> <p>Note: If there are more than six persons in this household, enter the first six on this questionnaire and continue on a second questionnaire. If you do not have a second questionnaire, note this in the "Comments" section on page 28. A census representative will contact you.</p>										

36 Overseas Codes



Long Distance Calls

Codes for Dialing Overseas

For station-to-station calls; DIAL/PRESS:
011 + Country Code + Routing Code + Local Number

For automated Calling Card™ calls; PRESS:
01 + Country Code + Routing Code + Local Number
+ (after tone) your 14 digit North American card number

For person-to-person and other types of calls; DIAL/PRESS:
01 + Country Code + Routing Code + Local Number

For countries or cities not listed; DIAL/PRESS:
"0" (zero) and ask the operator for the routing
codes.

Legend: * Routing codes not required
TD Approximate time difference
~ in hours from Eastern Standard time
NA Time difference not applicable

These overseas codes were in effect at the time of
printing this directory.

COUNTRY & COUNTRY CODE	ROUTING CODE	TD	COUNTRY & COUNTRY CODE	ROUTING CODE	TD	COUNTRY & COUNTRY CODE	ROUTING CODE	TD
Cameroon 237	*	+6	Cuba 53	*	NA	Ethiopia 251	*	+8
			Except Havana			Addis Ababa		
Chile 56		+2	Cyprus 357	*	+7	Afars and Issas		
Santiago	2		Larnaca	4		Dire Dawa	5	
Valparaiso	32		Limassol	5				
Vña Del Mar	32		Nicosia	2		Faroe Islands 298	*	+6
China 86		+13	Czech And Slovak 42			Fiji Islands 619	*	
Beijing (Peking)	1		Bratislava	7		Helsinki	0	
Chengdu	28		Brno	5		Tampere	1	
Shanghai	21		Prague	2		Umeå-Åbo	1	
Christmas Island 672		+12	Denmark 45	*				
All points	4							
Cocos Islands 672		+11½	Ecuador 593		NA	France 33	*	+6
All points	2		Cuenca	7		Except Paris and		
Colombia 57		NA	Guayaquil	4		Bordering Dept's	1	
Bogota	1		Quito	2				
Cali	23		Egypt 20		+7	French Polynesia 689	*	-5
Medellin	4		Alexandria	3				
Cook Islands 682	*	-4	Cairo	2		Gabonese Republic 241	*	+6
			Giza	3				
			Mahalah El-Kobra	43		Gambia 220	*	+5
			Port Said	66				
Costa Rica 506	*	-1	El Salvador 503	*	-1			
Cote d'Ivoire 225	*	+5						

TM Telecom Canada

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Overseas Calls

Codes for frequently called countries

For station-to-station calls: dial 011 + the country code + the routing code + the local number.

For person-to-person and other types of calls: dial 01 + the country code + the routing code + the local number.

For Automated Billing Service calls: dial 01 + the country code + the routing code + the local number, and (after the tone) the Automated Billing Service will tell you what steps to take to complete your call.

Dial 0 (zero):

- to obtain a number you don't know.
- to obtain credit for unsatisfactory calls, e.g. when you reach a wrong number.

Legend: * Routing codes not required.

TD Approximate time difference in hours from Eastern Standard time

= Time difference not applicable.

These overseas codes were in effect at the time of printing this directory.

COUNTRY & ROUTING CODE	TD	COUNTRY & ROUTING CODE	TD	COUNTRY & ROUTING CODE	TD	COUNTRY & ROUTING CODE	TD
Algeria 213 Alger 2 Constantine 4 Oran 6	+6	Brazil 55 Belo Horizonte 51 Brasília 61 Porto Alegre 51 Recife 81 Rio de Janeiro 21 Salvador 71 São Paulo 11	+6	Egypt 20 Alexandria 3 Cairo 2 Port Said 66	+7	Greece 10 Athens 1 Iráklion Kritis 9 Kavalla 51 Lárissa 41 Pátra 61 Thessaloniki 31 Volos 421	-1
Argentina 54 Buenos Aires 1 Córdoba 51 Rosario 41	+2	Chile 56 Santiago 2 Valeparaiso 32	+1	El Salvador 03	-1	Guatemala 502	-1
Australia 61 Adelaide 8 Brisbane 7 Canberra 6 Melbourne 3 Newcastle 49 Perth (Western) 9 Sydney 2	+16	China 86 Beijing (Peking) 1 Shanghai 21	+13	Finland 358 Helsinki 0 Tampere 31 Turku (Åbo) 21	+7	Escuintla 9 Guatemala City 2 Quetzaltenango 9	-1
Austria 43 Graz 316 Innsbruck 512 Linz 70 Salzburg 662 Vienna 1	+6	C.I.S. 7 (Commonwealth of Independent States) Kiev 044 or 0442 Moscow 095 St. Petersburg 812	+8	France 33 Paris and Suburbs 1	+6	Haiti 509 Hong Kong 852	+13
Bangladesh 880 Chittagong 31 Dhaka 2 Khulna 41	+11	Colombia 57 Bogotá 1 Cali 23 Medellín 4	=	Germany 49 Berlin 30 Bochum 234 Bonn 228 Bremen 421 Cologne (Köln) 221 Dortmund 231 Duisburg 203 Düsseldorf 211 Essen 201 Frankfurt am Main 69 Hamburg 40 Hanover 511 Munich 89 Nuremberg (Nürnberg) 911 Stuttgart 711	+6	Hungary 36 Budapest 1 Debrecen 52 Miskolc 46 Pécs 72 Szeged 62	+6
Belgium 32 Antwerpen 3 Brussels 2 Charleroi 71 Gent 91	+6	Czech & Slovak 42 Bratislava 7 Brno 5 Prague 2	+6	India 91 Ahmadábád 272 Bombay 22 Calcutta 33 Hyderábád 842 Kánpur 512 Madras 44 (New) Delhi 11	+10½	Indonesia 62 Bandung 22 Jakarta 21 Surabaya 31	+12

For countries or cities not listed: dial "0" (zero) and ask the operator for the appropriate codes.

1993
7.9.96 same

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OVERSEAS CALLS

How to make Overseas Calls

CUSTOMER DIALED CALLS : 011 + Country Code + City Code + Local Number

FOR PERSON TO PERSON, PHONE CARD

CALLS, THIRD PARTY BILLING AND

COLLECT CALLS :

01 + Country Code + City Code + Local Number

IF YOU ARE UNSURE OF THE COUNTRY OR CITY CODES, NEED OVERSEAS DIRECTORY ASSISTANCE OR NEED
HELP WITH YOUR CALL DIAL "0" OPERATOR

Points to Remember

- there are time differences
- it may take up to 45 seconds for an overseas phone to ring
- overseas ringing and busy signals are often different from those in Canada

Canada Direct* serving travellers abroad



Canada Direct service makes your long distance calling easier when you're travelling overseas, enabling you to place collect and phone card calls through a Canadian operator.

With Canada Direct :

- you can charge your call to your card or pay on delivery (no coin home in Canada)
- calls home to Canada are filled at Canadian long distance rates
- calls may be placed between and within overseas countries
- avoid potential language problems
- operator assistance is provided in both English and French

If you're planning on travelling, call 1 800 561-8868 (no charge) for the most current information on country listings and access numbers.

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Legend for Country and City Code Table

0 No time difference

★ City codes not required.

TD Approximate time difference in hours from Eastern Standard time

FREQUENTLY CALLED PLACES

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COUNTRY & CITY CODE	TD	COUNTRY & CITY CODE	TD	COUNTRY & CITY CODE	TD	COUNTRY & CITY CODE	TD
Algeria 213 Alger 2 Constantine 4	+6	Bangladesh 880 Chittagong 31 Khulna 41	+11	Chile 56 Santiago 2 Valparaiso 32	+1	Costa Rica 506	* -1
Argentina 54 Buenos Aires 1 Córdoba 51	+2	Belgium 32 Antwerpen 3 Brussels 2 Gent 9	+6	China 86 Beijing (Peking) 10 Shanghai 21 Tianjin (Tientsin) 22	+13	Croatia 385	+6
Australia 61 Adelaide 8 Canberra 6 Melbourne 3 Sydney 2	+16	Bosnia-Herzegovina 387	+6	C.I.S. 7 (Commonwealth of Independent States) Moscow 095 St. Petersburg 812	+8	Cyprus 357 Larnaca 4 Limassol 5	+7
Austria 43 Innsbruck 512 Salzburg 662 Vienna 1	+6	Brazil 55 Brasilia 61 Pôrto Alegre 51 Rio de Janeiro 21 São Paulo 11	+2	Colombia 57 Bogotá 1 Medellín 4	0	Czech & Slovak 42 Bratislava 7 Prague 2	+6
						Denmark 45	* +6

For countries or cities NOT listed dial "0" (zero) and ask the operator for the appropriate codes.
These overseas codes were in effect at the time of printing this directory.

*Trade mark of Teleglobe Canada Inc.

Zero

Measuring must start at 0. Counting is measuring.

An octave is an interval of 8. What interval is 2 octaves? It's 15.

How many years from July 1 in year X to July 1 in year Y? $Y - X$ years?

Fortran 1955 loop body had to be executed at least once.

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count:= 0.

while there's another one <https://powcoder.com>

do

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count:= count + 1

od

Algol 1958, PL/I, Pascal: array must have at least 1 element.

Zero

first: preceding all others in time, order, or importance 1st 0st

last: following all others in time, order, or importance

second: following the first 2nd 1nd

third year of life = what age? 2

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tenth annual picnic = how many years? 9

the eleventh hour: the latest possible time [10 to 11 o'clock]

the fifteenth item = item 15 ? item 14 ?

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zeroth item = item 0 ? first item

String Theory

Strings are indexed sequences.

$\leftrightarrow(x;..y)$ = $y-x$ Assignment Project Exam Help length “ x to y ” for $x \leq y$

$(x;..y) \ ; \ (y;..z) = x;z$ <https://powcoder.com>

“Don't say ““no””.” text

“abcdefghijklm”_{3..6} = “def” subtext

0; 1; 2: *nat*; 1; (0..10) distribution

$3*(4; 5) = 4; 5; 4; 5; 4; 5$ repetition

$*3 = \text{nil}, 3, 3;3, 3;3;3, \dots$ repetition

$$(3; 5; 9) \triangleleft 2 \triangleright 8 = 3; 5; 8 \quad \text{modification}$$

List Theory

[0; 1; 2]

a string in a package

[0; 1; 2]: [nat; 1; (0..10)]: [3*nat]: [*nat] distribution

$\sim[3; [5; 7]; 4] = 3; [5; 7]; 4$ content

[3; [5; 7]; 4] = 3

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[3; [5; 7]; 4] 2 = 4

length
index

[3; 5; 7; 4] [2; 1; 2] $\vdash_{[7; 8; 7]}$ composition

[3; 5; 7; 4];; [2; 1; 2] $\vdash^{[3; 5; 7; 4; 2; 1; 2]}$ join

[3; 6; 4; 1] < [3; 7; 2]

order

[3; 6; 4] < [3; 6; 4; 1]

order

2 → 22 | [10;..15] = [10; 11; 22; 13; 14] modification

List Theory

distribution

$$-(a, b) = -a, -b$$

negation of bunch = bunch of negations
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 $(a+b)\times(c+d) = a\times c + a\times d + b\times c + b\times d$

~~product of sums = sum of products~~
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$(a \vee b) \wedge (c \vee d) = a \wedge c \vee a \wedge d \vee b \wedge c \vee b \wedge d$
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conjunction of disjunctions = disjunction of conjunctions

$$[(2, 3); (4, 5)] = [2; 4], [2; 5], [3; 4], [3; 5]$$

list of bunches = bunch of lists

List Theory

modification

Let $L = [10;..15] = [10; 11; 12; 13; 14]$

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 $2 \rightarrow L3 \mid 3 \rightarrow L2 \mid L = [10; 11; 12; 12; 14]$ X
<https://powcoder.com>

$2 \rightarrow L3 \mid 3 \rightarrow L2 \mid L = [10; 11; 13; 12; 14]$ Add WeChat powcoder ✓

String and List Theory

$$S_{n,m} = S_n, S_m$$

$$L(n,m) = Ln, Lm$$

$$S_{\{n,m\}} = \{S_n, S_m\}$$

$$L\{n,m\} = \{Ln, Lm\}$$

$$S_{n;m} = S_n; S_m$$

$$L(n;m) = Ln; Lm$$

$$S_{[n;m]} = [S_n; S_m]$$

$$L[n;m] = [Ln; Lm]$$

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$$S_{0,\{1,[2;1];0\}}$$

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$$L(0,\{1,[2;1];0\})$$

$$= S_0, \{S_1, [S_2; S_1]; S_0\}$$

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List Theory

multidimensional structures

$A = [[6; 3; 7; 0] ;$

$[4; 9; 2; 5] ;$

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$[1; 5; 8; 3]]$

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$A : [3 * [4 * nat]]$

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$A[1] = [4; 9; 2; 5]$

$A[1][2] = 2$

$A(1, 2) = A[1][2], A(2) = [4; 9; 2; 5], [1; 5; 8; 3]$

$A[1, 2] = [A[1], A[2]] = [[4; 9; 2; 5], [1; 5; 8; 3]]$