A Bibliography of Publications on Floating-Point Arithmetic

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Introduction

This is a bibliography of material on floating-point arithmetic that I came up with while doing research on a floating-point package of my own. I don't claim it to be anywhere near complete. The material listed is only what I myself possess.

My main interest was in software based, binary floating-point arithmetic on a microprocessor, so you won't find much material about the hardware used in floating-point arithmetic (e.g. adders, carry propagation schemes, higher radix

representation for multiplication and division, etc.) in this list. There is also not too much on non-binary floating-point arithmetic.

For most fields covered in this bibliography, the important or historically relevant articles should be included. There is also some material on integer arithmetic in this list as some of the methods used with integer arithmetic contain interesting ideas that may be useful in the realization of a floating-point arithmetic package.

Also, depending on the type of microprocessor used, one may need to implement integer multiplication and division for use in the floating-point package, so articles about this topic are included as well.

As I am German, there is a bit of material in German in this bibliography. However, English translations are provided for all non-English titles.

Thanks to the people who have helped me with previous versions of this document by sending me papers or additional references:

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- K. C. Ng (`kwok.ng@eng.sun.com`),
- Nelson H. F. Beebe (`beebe@math.utah.edu`).

Bibliography entries in the **Books** section are ordered alphabetically by author; ordering is by ascending year in the remaining sections.

Warning: it has yet not been possible to bring this citation list up-to-date with the entries in the BibTe

Books, hardware oriented

[1721, 281, 1286, 1216, 3111, 3315, 1916, 841, 1164, 1000, 1457, 843, 1343, 7249, 7250, 1557]

Books, software oriented or theory

[1273, 466, 469, 470, 119, 1420, 2393, 908, 1049, 352, 2952, 2434, 2969, 2270, 320, 527, 7103]

Books, machine specific

[2175, 3217, 3113, 2436, 1767, 1903, 2289, 1935, 2471]

Journal Publications, Conference Papers, Technical Reports, Ph.D. Dissertations, Book Contributions, etc.

1 Choice of base, floating point formats

[498, 750, 752, 730, 727, 893, 1141, 1131, 2036, 2267, 2391, 2544, 2771, 2785]

1.1 Precision and Rounding

[433, 558, 745, 847, 881, 896, 964, 1032, 1041, 1045, 1194, 1296, 1435, 1376, 1538, 1729, 2280, 2456, 2529, 2842, 3158, 3280]

1.2 Determination of parameters of floating point arithmetic

[686, 823, 1636, 2273, 2201]

1.3 IEEE standards for floating point arithmetic

[993, 1197, 1223, 1206, 1234, 1196, 1203, 1340, 1326, 1327, 1280, 1300, 1458, 1385, 1409, 1387, 1725, 1824, 1862, 1863, 1860, 2087, 2172, 2339, 2573, 3053]

1.4 Floating point arithmetic, general and implementation issues

[633, 719, 1014, 1035, 1083, 1095, 1094, 1236, 1238, 1210, 1274, 1266, 1475, 1493, 1992, 2012, 2217, 2218, 2372, 2446, 2349, 2528, 2772, 2773, 2701, 2770, 3011]

1.5 Floating point packages

[1287, 1700, 1679, 1773, 1731, 1884, 1849, 1885, 1967, 2080, 2102, 2204, 2298, 2299, 2300, 2479, 2480, 1352]

1.6 Floating point units

[416, 1153, 1320, 1278, 1330, 1354, 1323, 1349, 1270, 1315, 1324, 1498, 1540, 1497, 1533, 1556, 1662, 1576, 1578, 1579, 1680, 1610, 1607, 1615, 1642, 1716, 1618, 1789, 1776, 1716, 1757, 1786, 1718, 1797, 2008, 1970, 1998, 1964, 2017, 1956, 1949, 1950, 2128, 2082, 2153, 2245, 2274, 2307, 2250, 2276, 2251, 2184, 2213, 2320, 2262, 2214, 2287, 2461, 2407, 2408, 2432, 2322, 2443, 2405, 2402, 2314, 2424, 2463, 2363, 2323, 2444, 2328, 2564, 2499, 2519, 2559, 2514, 2491, 2562, 2545, 2536, 2659, 2768, 2731, 2957, 2870, 2940, 3097, 3047, 3188, 3347]

1.7 Test of floating point routines

[500, 1454, 1726, 1870, 1869, 2020, 2021, 1965, 2106, 2469, 2597, 2605, 2673, 2672, 2788, 2767, 2753, 3052]

2 Addition and Subtraction

[375, 1513]

2.1 Floating-point Summation

[325, 345, 362, 361, 570, 639, 677, 831, 1661, 2275, 2352]

2.2 Multiplication

[680, 1246, 1260, 1476, 1543, 1516, 1574, 1601, 1593, 1619, 1676, 1591, 1758]

2.3 Division

[209, 238, 223, 322, 348, 438, 1017, 1064, 1311, 1403, 1567, 1645, 1623, 1606, 1770, 1890, 2015, 1994, 2387, 2777, 2722, 2967, 3016, 7271, 2949]

3 Elementary functions, general

[384, 398, 586, 650, 615, 1122, 1265, 1627, 1656, 1756, 1719, 1717, 1794, 1840, 7190, 1945, 2051, 2154, 2098, 2277, 7209, 2560, 2597, 2547, 3334, 2549, 2518, 2697, 2850, 2661, 2812, 2813, 2690, 3367, 3335]

3.1 Elementary functions, CORDIC and related algorithms

[190, 191, 248, 264, 373, 523, 551, 659, 651, 667, 733, 855, 1068, 1084, 1293, 1451, 1699, 1897, 1708, 1811, 1963, 2159, 2381, 2310, 2541, 2567, 2716, 2810, 3010, 3005, 3128, 3068, 3114]

3.2 Elementary functions, function approximation

[240, 241, 481, 623, 768, 767, 983, 1021, 1162, 2000, 2052, 2610, 2685, 2783, 2784]

3.2.1 Polynomial evaluation

[259, 279, 304, 426, 1061, 1228, 2351]

3.3 Square root, general

[1082, 1187, 1481, 1598, 1651, 2565, 2677]

3.3.1 Square root, bit-oriented, iterative, and table methods of computation

[120, 153, 359, 1022, 1008, 1151, 1353, 1444, 1406, 1372, 1426, 1537, 1825, 1922, 1834, 1887, 1971, 1952, 2035, 1955, 2006, 2046, 2089, 2139, 2179, 2253, 2390, 2577, 2534, 2709, 3038]

3.3.2 Square root, Newton's method

[158, 280, 302, 374, 347, 343, 383, 451, 427, 513, 518, 532, 596, 585, 579, 581, 702, 1328, 1317, 1397, 1583, 2333, 3018, 2947]

3.4 Sine and Cosine

[180, 1068, 1018, 1023, 1176, 1398, 1544, 1666, 1665, 1765, 1853, 1953, 2120, 2231, 2606, 2961, 2958, 2880, 2980, 3074]

3.5 Logarithm

[154, 271, 331, 690, 998, 1112, 1299, 1529, 2107, 2108, 2607, 2735]

3.6 Exponential function

[141, 409, 1183, 1361, 1518, 1748, 1847, 2470, 2608, 3002]

3.7 Arctangent

[143, 160, 207]

3.8 Other transcendental functions

[499, 613, 161, 1024, 365, 275, 360, 2100, 1157, 2860, 3054]

4 Binary-decimal conversion

[189, 173, 222, 475, 576, 684, 1165, 1291, 1292, 1405, 1654, 1709, 2002, 1975, 2509, 2601, 2525, 2856]

5 BCD arithmetic

[674, 726, 777, 778, 779, 780, 781, 782, 783, 1382, 1492, 1705, 1640, 2037, 2646, 2960]

6 Multiple precision arithmetic

[292, 330, 410, 428, 632, 616, 953, 1002, 1099, 1098, 1265, 1350, 1430, 1542, 2805, 2789, 3033, 3224]

7 Conferences on computer arithmetic

[7129, 7139, 7144, 7153, 7156, 7169, 7187, 7188, 7230, 7260, 7268, 7262, 7294]

8 Additional contributions from Nelson H. F. Beebe

[121, 136, 169, 215, 297, 346, 367, 449, 752, 555, 848, 877, 921, 922, 974, 988, 1002, 1007, 1070, 1072, 1099, 1098, 1192, 1163, 1221, 1245, 1264, 1271, 1288, 1388, 1425, 1430, 1459, 1460, 7169, 1714, 1724, 1727, 1741, 1747, 1855, 1861, 1895, 1923, 1979, 2022, 2033, 2061, 2103, 2116, 2124, 2169, 2275, 2276, 2329, 2486, 7242, 2531, 2535, 2548, 2555, 2564, 2605, 2617, 7268, 2740, 2741, 2765, 2769, 2786, 2805, 2858, 2859, 2972, 3052, 3267, 208, 215, 216, 252, 282, 294, 306, 307, 311, 342, 362, 421, 440, 473, 492, 526, 570, 592, 616, 639, 710, 794, 827, 829, 845, 864],[897, 899, 904, 926, 947, 973, 975, 982, 984, 1016, 1063, 1071, 1252, 1283, 1357, 1430, 1437, 1461, 1464, 1559, 1564, 1624, 1638, 1647, 1648, 1703, 1744, 1784, 1788, 1807, 1808, 1813, 1815, 1832, 1843, 1844, 1936, 1968, 2013, 2024, 2097, 2141, 2170, 2186, 2249, 2264, 2279, 2301, 2360, 2371, 2375, 2457, 2481, 2487, 2532, 2579, 2593, 2656, 2666, 2702, 2746, 2797, 2861, 2928, 2934, 2968, 2994, 3002, 3037, 3090, 3098, 3176, 3190, 3193, 3237, 3278, 3325, 7100, 7137, 7145, 7154, 7155, 7180, 7192, 7189, 7235]

Title word cross-reference

#26 [5489].

$((2^n)^m)$ [3797]. $(10^{31}-1)/9$ [1976]. (2^m) [4350, 4371, 4555, 4564, 4469]. (2^n+1) [1081, 4787, 3910]. (2^n-1) [5006]. $(2^n-1, 2^{n+p}, 2^n+1)$ [6269]. $(2^n 2^q 1)$ [6075]. $(2^n \pm 1)$ [5516, 4137]. $(2m)$ [4434]. $(2n+3)$ [6524]. $(2n-(2p\pm 1))$ [4849]. $(a\cdot x)\cdot x?$ [6797]. (d,r) [789]. (M,p,k) [5802]. $(\mathcal{R})$ [2908]. (p) [4350, 4434].

$(x+y)*(x-y)$ [6670]. -2 [743, 183, 206, 949, 801]. $-\infty < n < +\infty$ [141, 160]. 0 [5634]. $0 < N < 1$ [161]. $0 \div 0$ [699]. **$1** [3739]. 1 [4986, 4343, 5151, 5635, 3694, 2165]. $1,000,000$ [618]. $1/\sqrt{x}$ [5773]. $1/t$ [2174]. 10 [530, 6006]. 116 [4019]. 128 [4855]. 15 [530]. 16 [2504, 4184, 4072]. 17×69 [3047]. 2 [1005, 4301, 2049, 5671, 3229, 3991, 618, 6039, 430, 4343, 5007, 3283, 3459, 1760, 3469, 3140, 3476, 5609, 3491, 530, 321, 3681, 3816, 4450, 3694, 5095, 3361, 4939]. $2,576,980,370,000$ [5636]. $22n+1$ [2146]. 256 [4437]. 27 [433]. $2^(n+1)+1\}$ [3968]. $2^{2n+1}-1$ [6021]. $2^{2n+2}-1$ [6021]. 2^{2q} [6011]. 2^8-1 [2856]. 2^k [4482, 4994, 5496, 5035, 5043]. 2^k+1 [866]. 2^{k-1} [4482]. 2^m [4556]. 2^n [1568, 6021, 3968]. 2^n+1 [3968, 4986, 5715, 4460]. $2^{n+1}-1$ [6514]. 2^{n+k} [6514]. $2^n-(2^{n-2}+1)$ [5338]. 2^N-1 [2987, 4822, 6514, 4213, 3968]. 2^q-3 [7004]. $2^q \pm 1$ [6011]. $2^q \pm 3$ [6011]. $2^x p^y \pm 1$ [6237]. 2×2 [5908]. 3 [377, 4988, 4178, 430, 4034, 4202, 4039, 5027, 4872, 321, 6206, 4118, 6598, 4936, 4937]. $3-j$ [298]. 32 [3984, 4437]. 3×3 [2493]. 4 [3968, 4315, 4659, 2521, 2522, 430, 3428, 5720, 5522, 4382, 4715, 2950, 4072, 4074, 2811, 3001, 1932, 3524, 3529]. **$49.95** [3706]. 5 [6011, 4799]. 54×54 [3483]. $6-j$ [298]. 64×64 [2278]. 8 [433, 3441, 4072, 3491]. 84 [307]. **$85.00** [4142, 4143]. 88062 [530]. $8k$ [6834]. 8×8 [5095]. $9-j$ [298]. $<$ [6214]. $>$ [6214]. $[0,1]$ [5151]. ^{0} [4356]. ^{2} [5733]. ^{4} [2796]. ^{5} [3897]. ^{e} [1159]. th [1159]. ^{TM} [4626]. $A(N+C)$ [1910]. $a+b$ [3638]. $a+b+c$ [6295]. $AB+CAB+C$ [6942]. $ab+cd$ [6090]. $ab+cd+e$ [7080]. $a\cdot(x\cdot x)$ [6797]. $A\cdot T$ [4065]. $\arctan Z$ [143]. $a\times b+c\times d$ [6295]. β [6326, 7047]. $C+AB^2$ [4280]. $c/\sqrt{(a^2+b^2)}$ [6277]. $\mathrm{CLP}(R)$ [2928]. $\cos^{-1}$ [3128]. $\cos N$ [180]. $\cos x$ [373]. $\cot^{-1} x$ [373]. d [4693, 5499, 3803]. Δ_2^0 [4940]. e [459]. e^n [141]. e^x [409]. ϵ [3472]. η_T [5663]. ηT [5243]. $\exp(x)$ [1361]. $\exp x$ [373]. $f(x)=0$ [1222]. G_α [809]. $\mathrm{GF}(2)[x]$ [5856]. $GF(2^m)$ [4404, 4772, 4387, 6040, 4973, 5429, 4904, 5860]. $\mathrm{GF}(2n)$ [4199]. $GF(p^m)$ [4651]. H [5168]. I^2L [3238]. ∞/∞ [5014]. K [5437, 4301, 5910, 2107, 5994, 6326, 5951]. $k<m$ [6326]. L [4343]. L^2 [5251]. L^∞ [5250, 6972]. l_2 [6050]. $\ln(x)$ [1529]. $\ln x$ [373]. $\log n$ [1228]. $\log Z$ [143]. LU [6786, 6546]. M [4836, 180, 4132, 2626, 2631, 2640, 2918, 5332, 581, 6326]. $M^E \bmod N$ [2776]. $\mathbf{F}_2[X]$ [7046]. $\mathbf{f}_{2^m}$ [4229]. $\mathbf{F}_{5^{5n}}$ [5680]. $\mathbf{F}_{7^{7n}}$ [5680]. $\mathbf{R}^n$ [6895]. $\mathbf{Z}^2$ [4060, 5034]. $\mathrm{GF}(2)$ [5306, 1692]. $\mathrm{GF}(2^4)^2$ [6153]. $\mathrm{GF}(2^{4\mathrm{n}})$ [3921]. $\mathrm{GF}(2^8)$ [6153]. $\mathrm{GF}(2^{\mathrm{k}})$ [4961, 3768, 4919]. $\mathrm{GF}(2^{\mathrm{m}})$ [5479, 4672, 4979, 3873, 4526, 5140, 3581, 4532, 3884, 5508, 2896, 2897, 3752, 4859, 5306, 5169, 4714, 4385, 5031, 2428, 5430, 4604, 4745, 4905, 5434, 3198, 4280, 4934, 4771, 2308]. $\mathrm{GF}(2^{\mathrm{n}})$ [4993]. $\mathrm{GF}(\mathrm{p})$ [2081]. $\mathrm{GF}(\mathrm{p}^{\mathrm{m}})$ [3487]. $\mathrm{GF}(\mathrm{p}_{\mathrm{k}})$ [4647]. $\mathrm{GF}(\mathrm{q}^{\mathrm{n}})$ [4695]. MECIPTI [282]. μ [1426, 4865, 4907, 2309]. μP [1610, 2008]. N [3963, 808, 2333, 2334, 160, 161, 180, 4575, 5067, 4925, 5951, 5682, 4159, 6050, 1294, 3622]. $n^{\text{ième}}$ [1159]. $N_0' = -N_0^{-1} \bmod W$ [4257]. $N \geq 32$ [5845]. $n\log(n)$ [6462]. $n \times n$ [3139]. $O(1)$ [6362]. $O(n)$ [1195, 3431, 1547]. $O(n^2)$ [2777, 2778]. $O(n\log n)$ [6511]. Ω [4921]. $\mathrm{Arccos}x$ [207]. $\mathrm{Arcsin}x$ [207]. $\mathrm{Arctan}x$ [207]. $\mathrm{mod}p$ [1915]. P [6502, 4636, 2059, 1130, 894, 1044, 1635, 7047, 4273, 4622, 3349]. p^k [6678]. π [1630, 2233, 2234, 4601, 268, 5636, 1693, 459]. $p \times p$ [4580, 4724]. q [5775]. $q*m-n$ [1628]. QR [6115]. R [3602, 3061, 1605, 1613, 6405, 5845]. $r=m^k$ [1438]. r^a [4944]. r^b-1 [4944]. r^c+1 [4944]. $\{r^n-2, r^n-1, r^n\}$ [5297].

$r \geq 8$ [5845]. s [4876]. sin(**BIG**) [5232]. $\sin^{-1}$ [3128]. $\sin N$ [180]. $\sin x$ [373]. $\sqrt{(a^2 + b^2)}$ [6277]. $\sqrt{(x)}$ [1481]. $\sqrt{(x/d)}$ [3845]. $\sqrt{2}$ [6976]. $\sqrt{x}$ [1307, 451]. $\sqrt{x^2 + y^2}$ [5671]. T [6562]. $\tan^{-1} x$ [373]. $\theta(\log N)$ [2354]. $\times$ [4065, 3915, 4131]. w [4732]. X [1542, 2893]. $x^2 + ny^2$ [3706]. x^n [5974, 3307]. y [4413]. Z [5329].

-2 [1004]. **-adic** [1130, 1044, 1635, 2059, 894]. **-Approximations** [6972, 5250, 5251]. **-ary** [2918, 4132]. **-b** [3483]. **-Bit** [3984, 6834, 307, 5951, 5067]. **-body** [4575, 4925]. **-circulant** [6405]. **-Coordinate** [4413]. **-count** [6562]. **-D** [5671, 4178, 4202, 3283, 6206, 4118, 5095, 3361, 2165]. **-Depth** [3431]. **-Digit** [433]. **-Dimensional** [5499, 2049, 4693]. **-Fold** [5437]. **-Friendly** [5802]. **-function** [5168]. **-gram** [5682]. **-Matrix** [4836]. **-Moduli** [6011, 3968, 4659, 4799]. **-Norms** [6050]. **-Order** [3602]. **-Partition** [5994]. **-Real** [4940]. **-select** [4159]. **-sets** [3061]. **-spaces** [4876]. **-th** [5910, 3803, 5775, 2334]. **-transform** [5329]. **-Vectors** [6050].

.NET [6415, 5070].

/m [4865]. **/spl** [4865].

0.18-CMOS [5769]. **0.4.1rc** [6416]. **0.80pJ** [6550]. **0.80pJ/flop** [6550]. **'00** [7370, 7375, 2540]. **'01** [7384]. **'03** [7413]. **'04** [7422, 7430]. **'07** [7465, 7471, 7473, 7478]. **'08** [7482, 3032, 5377].

1 [217, 3547, 6636, 3412, 2876, 228, 63, 65, 67, 563, 3275, 6668, 4065, 4407, 1163, 5769, 7052, 1933, 3865]. **1-GHz** [6636, 4407, 5769]. **1-Output** [5343]. **1.0** [3866]. **1.24Tflop** [6550]. **1.24Tflop/sW** [6550]. **1.5** [5651]. **10** [5733]. **10-kA** [5733]. **10-kA/cm** [5733]. **10/20** [958]. **100** [2889, 2890]. **100-MFLOPS** [2889, 2890]. **1014** [6741]. **1057** [1981]. **10858** [1746]. **10967** [4361, 5157]. **10967-1** [3275]. **10967-2** [4361]. **10967-3** [5157]. **10th** [7180, 7514, 7262, 7391, 7404, 27, 7161, 2763]. **'11** [7509, 1110, 1391, 1507, 1408, 1312]. **11-bit** [4907]. **11/780** [2036, 1569, 1570, 1803, 1019]. **116** [270]. **1164/WTL** [2033]. **11i** [4922]. **11th** [7382, 7275, 7293, 7294, 3183]. **120B** [1120]. **128-bit** [6317, 4116]. **12th** [7425, 7491, 7136, 7317, 3454, 7477]. **13** [4320, 2090]. **132-Bit** [342]. **13th** [7410, 7152, 7336, 7306, 7464, 3844, 3772, 7534]. **14-Port** [3915]. **14th** [7297, 7381, 7412, 7463, 7375, 7361]. **15** [2766]. **15-b** [4452]. **15-bit** [4121]. **15C** [1629]. **15th** [7200, 7471, 7136, 7479, 7383, 7429]. **16-19** [7100]. **16-b** [6451]. **16-Bit** [4531, 6676, 6691, 7061, 6834, 3023, 1260, 1601, 4991, 3076, 1759, 6316, 1476]. **16-bit-** [1610]. **16-bit-Multiplikation** [1476]. **16-by-8-bit** [1645]. **16-Digit** [5363]. **160-ns** [2835]. **160-Word** [3915]. **1620** [255]. **164** [1815]. **167** [3491, 3529]. **16BST** [1817, 1733, 1734, 1736, 1740, 1750, 1763, 1772, 1689]. **16F/400** [917]. **16th** [7454, 7445, 4648, 7409, 7451]. **17** [287, 838]. **17-Bit** [648, 647]. **1788** [6538]. **1788-2015** [6064]. **17th** [7516, 7456, 7372, 7446, 7449]. **'18** [7527, 562]. **18-21** [7462]. **18.Mai** [1484]. **18th** [7481, 7470, 7476, 5469].

18th-Century [5469]. **1945** [61]. **1947** [7092]. **196** [5678, 5689]. **1962** [7100]. **1965** [7104, 7106]. **1967** [7111, 7113]. **1968** [7116]. **1969** [7114, 7115, 587]. **1971** [7126]. **1972** [7124, 4046]. **1973** [4123, 4124]. **1975** [7133]. **1976** [7134, 7136]. **1977** [7137, 7162, 1652]. **1979** [7142, 7145]. **1980** [7146, 7152, 1525, 7157, 7154]. **1981** [7159, 7164]. **1983** [7180]. **1984** [7189]. **1985** [7206]. **1987** [2087]. **1988** [7209, 7220]. **1989** [7233, 2579]. **1989-01** [2385]. **1989/Taipei** [7233]. **1991** [2635, 7255, 2763]. **1992** [2855, 7318]. **1993** [7286, 7329, 3183]. **1994** [7307]. **1994-12** [3275]. **1995** [7308, 7320, 3454]. **1998** [7346, 7348, 3892]. **1998-12** [3891]. **1999** [7358, 7359, 7364, 7366]. **19th** [7489, 7459]. **1st** [7343].

2 [2176, 6463, 2517, 1734, 64, 66, 68, 4361, 4035, 4573, 6423, 3918, 4890, 528, 2014, 7053, 3513, 4116, 4764, 2821, 3013]. **2-D** [3513]. **2-Digit** [4172]. **2-dimensional** [2988]. **2.0** [3618]. **2.44** [4034, 4202]. **20** [2665, 2399]. **20-MFLOPS** [2400, 2399]. **200-ns** [1485]. **'2000** [7369, 7368, 7369, 7375]. **2001** [7380, 7381, 7383, 4824, 7385, 7391, 7392]. **2002** [7394, 7395, 7397, 7398, 7399, 7406]. **2003** [7409, 7410, 7413, 7414]. **2004** [7421, 7422, 7424, 7430, 7431, 4882]. **2005** [7438, 7439, 7441, 7444, 7450]. **2006** [7453, 7454, 7457, 7461]. **2006Petrozavodsk** [7511]. **2007** [7465, 7467, 7468, 7470, 7473, 7475, 7485, 7480]. **2008** [7481, 7482, 5481, 7484, 6523, 5915, 5916, 6687, 5533, 5752, 5555]. **2009** [7487, 7491, 7494, 7495, 5514]. **2010** [7504, 7505, 7507]. **2011** [7510]. **2013** [7515]. **2015** [7518, 7519]. **2016** [7523]. **2017** [7524]. **2018** [6436]. **2019** [6489, 7529, 7530]. **2020** [6618, 6616, 6617, 6619, 6620, 6622, 6643, 7531, 6667]. **2020s** [6726]. **2021** [6726, 6727, 6728, 6729, 6737, 7535, 6783, 6801]. **2022** [6839, 6840, 6841, 7537, 6868, 6869]. **2023** [7539]. **20th** [7493, 7533, 7512, 7474]. **21-23** [7491]. **2100** [2558]. **21064** [3341]. **210uW** [6386]. **210uW/MHz** [6386]. **21164** [3386]. **21st** [7499, 7427, 7371, 7515, 7488]. **22** [337]. **22-nm** [6636]. **22nd** [7519]. **22nm** [6550]. **23-28** [7458]. **23nd** [7523]. **23rd** [7245, 7502, 7505]. **24** [1127]. **24-26** [7411]. **24-bit** [2364]. **24.und** [7162]. **24732** [5159]. **248GOPS** [6814]. **248GOPS/W** [6814]. **24b** [2461]. **24th** [7524, 7344, 7347, 7401, 7507, 7162]. **25-28** [7370]. **256** [6274]. **25th** [7241, 7357, 7162, 7472, 7528]. **26-28** [7422]. **26th** [7507, 7530]. **27th** [7531, 7504]. **281** [3055]. **286** [3637]. **28nm** [6814]. **28th** [7535, 7352]. **29.95** [3706]. **29th** [7360, 7537]. **2B** [645]. **2DFFT** [1883]. **2nd** [7503, 4577, 7125]. **2Sum** [6129, 6236].

3 [3093, 5157, 6399, 2769, 6104]. **3-ps** [5769]. **30-bit** [2421]. **30-MFLOP** [2245]. **30-ns** [3469]. **300** [4202, 1229]. **300-MHz** [4202]. **300MHz** [4034]. **30th** [7539]. **312** [432]. **3171** [2499]. **31st** [7214]. **32** [5113, 2061]. **32-** [6903]. **32-Bit** [3714, 2312, 2183, 2325, 5473, 4802, 3412, 1403, 5003, 1623, 2734, 2406, 2407, 2408, 2409, 2557, 1996, 2431, 3309, 2569, 3187, 3950, 2484, 3202]. **320** [3096]. **320-MFLOPS** [3097, 3096]. **320C25** [3287]. **32b** [2245]. **33** [2213]. **33rd** [7325, 7376, 7269]. **34** [512]. **34-MFLOP** [2484]. **360** [417, 418, 504, 383, 391, 392, 681, 439, 480, 1441, 6432, 537]. **3600** [302]. **36th**

[7289]. **370** [1945, 2036, 2478]. **37th** [7475]. **390** [4076, 3811, 3812, 4102, 4103]. **39th** [7465, 7482]. **3CT** [3381]. **3DNow** [3918, 4035]. **3DTV** [5758]. **3m** [6341]. **3rd** [7341, 7129, 7447]. **3X** [5435].

4 [3391, 4788]. **4-2** [1167]. **4-Input** [5343]. **4-Input/1-Output** [5343]. **4.4ns** [3483]. **40** [2408]. **40-MFLOPS** [2406, 2408]. **40-ns** [648]. **400** [917]. **4000** [497]. **400MHz** [3915]. **400th** [7318]. **4096-Core** [6828, 6714]. **40ns** [647]. **41** [443]. **432** [1856]. **44th** [7461]. **45th** [3759]. **48th** [7444]. **4d** [4670]. **4m** [6341]. **4th** [7139, 7370, 7264, 7392, 7538].

5 [3539, 6923]. **50** [2323]. **50-Megacycle** [149]. **50-MHz** [2323]. **501** [3776, 3628]. **50th** [7301]. **512** [6349, 6984]. **512-bit** [6854]. **528** [1118, 4017]. **53*53** [3261]. **53nd** [7500]. **54** [338]. **54-b** [2835]. **55-b** [3469]. **5th** [7408, 7490, 7156, 7459, 7315].

6.7-MFLOPS [2442, 2444]. **60** [605, 578, 410]. **600** [3983]. **600-MHz** [3983]. **6000** [3381, 2535, 636, 2560, 2564, 1242, 3363, 717]. **6000/7000** [1036, 1242]. **600MHz** [4076]. **601** [3341]. **603e** [3611]. **60M** [2634]. **60M-flops** [2634]. **64** [4777, 3990, 4164, 4025, 4190, 4191, 6509, 4236, 4112]. **64-active-instruction** [3525]. **64-b** [3637, 2957, 3525]. **64-Bit** [2432, 3915, 7042, 2320, 2323, 5384, 5126, 4985, 3069, 3429, 5151, 2711, 3443, 2399, 2400, 2545, 2404, 2924, 6903, 2768, 2259, 3323, 4923, 2033]. **64-bit-Universal-Floating-Point-ISA-Compute-Engine** [6509]. **6400** [1694]. **64b** [2322]. **65** [624]. **65-nm** [7042]. **65/6600** [624]. **650** [2089]. **651** [2048]. **65nm** [6386]. **6600** [731, 554, 624, 591, 1345]. **6600/7600** [731]. **665** [2201]. **68000** [1884]. **68000-Einplatinenrechner** [2080]. **693** [2805]. **6th** [7455, 4832, 7420, 7169, 7359, 7474, 7337, 7450, 7424].

7-9 [7493]. **70** [5674]. **7000** [1242]. **7094** [397, 472]. **7094-II** [472]. **714** [3052]. **715** [3054, 3665]. **719** [3033]. **722** [3053]. **7289** [6976]. **73** [1029]. **754** [3838, 5564, 2857, 4303, 3394, 6026, 3974, 4509, 5481, 6489, 6867, 3866, 4325, 6760, 4821, 6766, 6767, 1409, 6520, 6780, 6161, 1861, 6523, 2093, 3449, 3614, 5923, 5320, 4231, 5042, 5178, 6900, 6559, 7036, 7037, 2271, 6436, 6323, 7047, 1679, 4751, 3936, 5629, 2016, 1458, 6707, 7087, 3350, 5555, 5780, 7069]. **754-1985** [1860, 1861]. **754-2008** [5420, 5481, 6523, 5555]. **754-2019** [6522, 6489]. **754-Posit** [6900]. **754r** [5411, 5116, 5129, 5261, 5482, 5162, 5215, 5161, 5174, 5363]. **7600** [731]. **77** [1190, 4017, 1331]. **780** [2036, 1569, 1570, 1803]. **786** [3939]. **'79** [7142, 7145]. **7th** [7146, 7148, 7453, 7187, 7217, 7458].

8 [1295]. **8-Bit** [3805, 6826, 6955, 1967, 7002, 7025, 6909, 6447]. **8-to-64** [6550]. **80** [1483]. **80*87** [3014]. **80-bit** [1928]. **80-FLOPS** [2957]. **8000** [3443]. **80287** [1903]. **8080/8085** [1583, 1133, 1219]. **8080A** [1487]. **8085A** [2386]. **8086/80286** [1935]. **8087** [1629, 1315, 1903]. **8087/80287** [1935, 1903]. **8087/80287/80387** [2289]. **8088/8087** [1733]. **80960** [2241].

80960KB [2242]. **80b** [2443]. **80h** [1295]. **80's** [7151]. **814** [4440]. **8231A** [4141]. **826** [6386]. **'83** [7172]. **83S87** [2512]. **'84** [7181]. **842** [4996]. **'85** [7186, 480]. **854** [3401, 3402, 2087, 3473]. **854-1987** [2039, 2087]. **'86** [7193, 7194]. **86**^{TM} [3914]. **871** [5440]. **'88** [7215, 7216, 7219, 2305]. **881** [5497]. **'89** [7227, 7234]. **89/TI** [4453, 4454]. **8s** [765]. **8th** [7239, 7439, 7348, 7201, 5618].

9 [516, 695]. **9-11** [7467]. **9.4** [6814]. **'90** [7237, 7246, 7261, 4296, 3385, 4956, 4957, 2675, 3481, 4440, 3830]. **908** [5647]. **90nm** [4788]. **'91** [7258, 7261, 416, 395]. **'92** [7267, 7270, 7273, 7281, 4453, 4454]. **'93** [7284]. **'94** [7296, 7297, 7306]. **'95** [7313, 3843, 4436, 4748]. **954** [6042]. **'96** [7327, 7331]. **96-bit** [2255]. **97** [3707]. **'98** [7344, 7352, 3960, 7342]. **980A** [1015]. **'99** [7357, 7358, 7359]. **9th** [7230, 7505, 7462, 7164, 2356].

= [2799, 2800, 3343, 7126].

A-Priori [2100]. **A.K** [4665]. **a.k.a** [5528]. **A/D** [3882, 905, 3343, 4121, 4452, 801]. **A/D-konverter** [3343]. **A1** [1098, 1192]. **Aarhus** [7169, 7169]. **Abacus** [202, 1026, 5532]. **Abbreviating** [7]. **abc}** [4806]. **ABE** [546]. **ABI** [6835]. **abnormal** [6015]. **Abotec** [3177]. **Absolute** [3388, 3389, 2759, 2249, 432]. **Abstract** [5572, 4537, 5605, 525, 5326, 5840, 6336, 4833, 2908, 2111, 5841, 4885, 4897, 2982]. **abstraction** [5468, 5819, 1329]. **abstraction-based** [5468]. **Abstracts** [7285, 7376]. **Abu** [407]. **Acadiana** [7348]. **ACBAM** [6921]. **ACBAM-Accuracy-Configurable** [6921]. **Accelerate** [6570, 6268, 4575]. **Accelerated** [6765, 5009, 5480, 5686, 6418, 6943, 7060]. **Accelerating** [5460, 6020, 4794, 3861, 5695, 6875, 6764, 6152, 7020, 4230, 6684, 6307, 4722, 6312, 5761]. **Acceleration** [6658, 6786, 6177, 6779, 6408]. **Accelerator** [6022, 6738, 6469, 5678, 6983, 5714, 7001, 6285, 6890, 6303, 2250, 6423, 7035, 5996, 6918, 4905, 7059, 6936, 6596, 6363, 2263, 7050]. **Accelerators** [6879, 6991, 6532, 7007, 6791, 7027, 6427, 7067, 4767, 6947, 5273, 3497]. **Acceptance** [3481]. **Access** [2142, 5104, 3394, 4578, 4632, 6943]. **Accessibility** [7437]. **Account** [3]. **Accumulate** [6484, 4980, 6385, 6782, 6404, 6693, 6926, 5945, 3819, 6609, 6717, 4501, 6549, 3666]. **Accumulated** [1367, 574, 976]. **Accumulation** [6240, 2055, 1958, 179, 5912, 6168, 5302, 6070, 5539, 4423, 77, 453, 1071, 3701, 5800, 3727, 3752, 5740, 573, 5536, 2762, 95, 5443]. **accumulations** [4230]. **Accumulator** [3855, 4760, 6213, 379, 2692, 1031, 3309, 5770, 5855, 4762]. **Accumulators** [6477, 6305, 370, 1072]. **accuracies** [2599]. **Accuracy** [4640, 217, 6217, 6960, 6849, 1714, 5465, 860, 1014, 4792, 5384, 6749, 6750, 2673, 5884, 6032, 3235, 5891, 6140, 5269, 5137, 6147, 1840, 227, 228, 7077, 433, 389, 1289, 1851, 3604, 4546, 4358, 2377, 6395, 1745, 1980, 2539, 1620, 7003, 1983, 5907, 6281, 1627, 2397, 7008, 3114, 752, 5172, 6682, 831, 5177, 3787, 6921, 5767, 3160, 6202, 165, 6926, 1684, 2020, 2021, 6707, 410, 3521, 6824, 6938, 493, 6718, 6719, 5375, 6949, 5867, 5658, 5799, 1812, 4654, 5882, 6249, 6757, 6037, 6882, 3751, 3090, 1744, 6670, 2543, 2097, 1993, 5171, 5829, 5173, 6417, 3780, 1755, 5335, 6097, 7043]. **accuracy** [1678, 107, 2457, 1688, 1921, 1784,

6334, 2296, 3190, 6446, 3835, 544, 5109, 2051, 1210, 3642, 650, 1352, 2567]. **accuracy-adjustable** [7043]. **accuracy-guaranteed** [5335]. **Accurate** [5566, 5113, 1804, 2645, 2648, 2864, 1384, 4335, 4521, 4522, 4523, 4675, 4816, 4817, 3732, 4339, 5969, 6142, 6254, 4002, 5274, 2690, 6042, 4690, 4829, 4831, 5280, 2697, 5399, 5504, 5510, 4355, 6521, 6063, 5906, 5589, 5732, 5910, 5911, 3280, 5912, 6168, 230, 2547, 2236, 6891, 6542, 3294, 904, 570, 3464, 639, 5750, 6558, 7190, 4888, 4889, 5060, 5997, 2973, 1535, 5068, 5436, 5437, 5438, 5542, 5619, 5937, 5938, 3674, 3808, 3810, 4916, 5084, 4111, 2605, 6005, 6821, 3016, 597, 5952, 4481, 1794, 5789, 3045, 5247, 3236, 3415, 4676, 4169, 2361, 5503, 6260, 4196, 5905, 1867, 5908, 2730, 3118, 757, 758]. **accurate** [2948, 4729, 2956, 4731, 6095, 4245, 2145, 4444, 5210, 3003, 2837, 5453, 5229, 1094]. **Accurately** [3555, 6482, 2509, 5730, 5028, 2601, 4915, 6483, 6244, 4803, 4804, 5602, 5626]. **ACE** [945, 5101]. **achieved** [3020]. **Achieving** [6014, 5384, 5676, 6257, 1840, 4735, 5848]. **ACL2** [7394, 4262]. **ACL2-2002** [7394]. **ACM** [7209, 7296, 7421, 7422, 7437, 7438, 7452, 7465, 7481, 7482, 7457, 7384, 7400, 2090, 7406, 7423, 2343, 7314, 7261]. **ACM/IEEE** [7452]. **ACM/SIGDA** [7421, 7438]. **ACM/SIGPLAN** [7423]. **Acoustics** [7193, 7259, 7413, 7430]. **Acousto** [1906]. **Acousto-Optic** [1906]. **acquisition** [2498, 2665]. **ACRITH** [1980, 1812, 2539, 1983, 1869, 2102]. **ACRITH-XSC** [2539]. **across** [5320]. **ACSSC** [7485]. **ACT8837** [2335]. **ACTION** [6893]. **Activation** [6642]. **Activations** [6288]. **active** [5758, 3525]. **Activity** [5865]. **Actual** [5313, 6473]. **acyclic** [3205]. **Ada** [7296, 7239, 7275, 1872, 7296, 2318, 2641, 2642, 2866, 2867, 3225, 2502, 2658, 3418, 2349, 2073, 6044, 2523, 7275, 1525, 1749, 2103, 1756, 3634, 2764, 2137, 2808, 1701, 2836, 1483]. **Ada-Europe** [7275]. **Ada83** [3036]. **adaptable** [4327]. **Adaptation** [2869, 4397, 6809]. **adapted** [5978]. **Adapting** [2928, 4017]. **Adaptive** [5811, 6527, 4217, 3109, 1633, 2918, 6681, 6789, 6184, 2445, 1769, 3679, 3680, 3813, 1462, 1549, 6936, 2173, 1947, 1582, 1720, 4801, 4972, 6391, 5152, 2389, 3774, 3906, 1755, 2425, 6085, 2959, 3144, 5766, 3691, 5637]. **ADC** [4351, 2450, 4131, 4943]. **ADCOM** [7471]. **Add** [6466, 5466, 3047, 4657, 4970, 6240, 4318, 5478, 6982, 6143, 5148, 2536, 6664, 5298, 3444, 6401, 3893, 4379, 5316, 5317, 5318, 3120, 5747, 5540, 5616, 5427, 5428, 5067, 6922, 4752, 7062, 6206, 6345, 6608, 6492, 4482, 2327, 4796, 3051, 3579, 5001, 4023, 5008, 6157, 4551, 5012, 4565, 4866, 4064, 5985, 5045, 4731, 3148, 5625, 4759, 4930, 1704, 4634, 4774]. **add/sub** [3579]. **Addendum** [1230, 762]. **Adder** [6021, 3714, 3966, 4302, 4802, 5477, 4976, 1102, 5263, 2885, 335, 6878, 1124, 5726, 6399, 5733, 753, 3782, 6563, 5930, 5995, 3791, 3655, 6564, 5338, 5339, 4422, 4262, 4911, 5629, 6930, 533, 589, 936, 5359, 5555, 6823, 6444, 6344, 5366, 5558, 133, 5228, 5373, 802, 2183, 4971, 2674, 5965, 3059, 2882, 3252, 5709, 4545, 2900, 3105, 3106, 3107, 3108, 1428, 2747, 5925, 2111, 4874, 5752, 2953, 4243, 2791, 6923, 1167, 5770, 5855, 4614, 5441, 4923, 2478, 5781]. **Adder-Based** [6021, 3105, 3106, 3107, 3108]. **Adder/Subtractor** [5726, 6399, 6823, 4874, 5752]. **Adders** [6014, 4299, 607, 5675, 3048, 4156, 5475, 866, 6761, 6762, 6381, 5703, 2075, 2077, 5587, 5401, 5516, 4213, 5019, 4050, 4374, 6069, 6410, 6179, 6792, 5179, 7026, 7084, 6689, 2001, 6696, 2782, 3803, 4267,

4438, 5363, 4460, 1180, 1191, 1494, 2331, 2660, 3858, 3991, 2725, 1899, 5756, 4733, 4081, 7041, 3328, 5215, 7087, 2474, 4457, 4765]. **adders/subtractors** [7087]. **Addictive** [1871]. **Adding** [1382, 3391, 2324, 3866]. **Addition** [1360, 6453, 2038, 1086, 803, 1371, 6967, 463, 550, 4313, 4970, 3722, 4155, 4318, 1823, 4977, 1107, 671, 6375, 1393, 5581, 5277, 3072, 1513, 506, 4994, 6149, 1125, 1612, 3433, 5588, 6524, 5301, 743, 4858, 1873, 4375, 4053, 5913, 6075, 4716, 4868, 5033, 1143, 4875, 362, 3139, 1438, 5932, 1443, 5338, 4086, 921, 922, 3158, 2275, 1675, 2138, 454, 3808, 5073, 6929, 786, 213, 932, 3818, 4111, 3184, 5549, 5219, 6445, 5559, 414, 1705, 376, 5105, 4137, 3221, 4152, 4310, 4796, 3857, 4662, 3566, 4162, 4669, 6378, 2520, 4683, 1512, 1968, 508, 6653, 2895, 3255, 4199]. **addition** [2915, 4864, 2737, 3630, 4230, 1647, 1648, 3642, 2760, 3920, 2260, 3796, 4083, 4251, 2583, 2974, 652, 710, 4912, 926, 3689, 375, 845, 1927, 3190, 3694, 492, 3832, 2627]. **Addition-based** [4994]. **Addition-Related** [5932]. **Addition/Subtraction** [4155, 5913, 4716, 6929, 3857, 4662]. **additional** [3365]. **Additions** [7045, 3609, 3456, 1936]. **Additive** [4517, 5035, 5750, 484, 3591, 1663]. **Additively** [6561]. **Address** [2671]. **Addressable** [5055, 1560]. **adds** [1372, 6082]. **Adelaide** [7361]. **adequate** [2186]. **Adiabatic** [4760]. **adic** [1130, 1044, 1635, 2059, 894]. **Adjustable** [2103, 5546, 7043]. **adjustment** [3731]. **Ado** [2091]. **ADPCM** [3171, 3172]. **ADSP** [2558, 2942]. **ADSP-2100** [2558, 2942]. **Advance** [6785, 4794]. **Advanced** [3843, 4342, 5292, 3443, 7471, 4562, 7205, 7328, 7362, 7373, 7402, 7416, 7433, 3471, 3481, 5540, 7276, 7265, 1540, 2286, 933, 5221, 4467, 1812, 6854, 7455, 2031, 7389, 7448]. **Advances** [7094, 7105, 1220]. **Advancing** [2328]. **Advection** [6850]. **Adversarial** [6778]. **Aerospace** [7407]. **AES** [6732, 6153, 6435]. **af** [1367]. **Affair** [3407]. **affiliated** [7394]. **Affine** [6465, 4583, 6606, 4813, 5253, 4688, 5719, 5328, 5198]. **Affirmative** [3]. **AFIPS** [7098, 7185]. **after** [2014, 3688]. **Afternotes** [3688]. **Again** [6375, 1908]. **Against** [6343, 4402, 4587, 4589, 4732, 4633]. **Age** [5004]. **aggregation** [5337, 5421]. **aggressive** [4064]. **ago** [6101]. **Ahead** [5214, 802, 605]. **Ahmad** [407]. **ähnliche** [1699]. **AI** [6882, 6885, 6422, 7055, 7057, 7065, 6826, 5881]. **AI-based** [7065]. **AI/ML** [6885]. **Aid** [14, 681, 5056, 1561]. **Aided** [7488, 7314, 7384, 7431, 7263, 7331]. **Aiken** [4123]. **air** [4549]. **Aircraft** [51]. **Airy** [5881]. **Aizu** [7366]. **Aizu-Wakamatsu** [7366]. **al** [407, 407, 407]. **al-Fusul** [407]. **al-Hasan** [407]. **al-Hindi** [407]. **al-Uqlidisi** [407]. **ALA'01** [4824]. **Alabama** [7273]. **Alamos** [2750]. **Alan** [7440, 703]. **Albena** [7260]. **Albuquerque** [7258]. **Alegre** [7467]. **Alessandro** [7365]. **Algebra** [3546, 4500, 1580, 7186, 7298, 4335, 6377, 4824, 7008, 6794, 3481, 7055, 5957, 6239, 2066, 3877, 4698, 6671, 6672, 5833, 832, 2954]. **Algebraic** [7469, 7142, 5128, 429, 2366, 4183, 7342, 388, 5296, 5731, 3762, 3625, 7327, 4381, 2143, 7418, 1070, 3820, 5209, 7378, 5095, 7281, 7508, 7103, 7109, 4287, 45, 5249, 1826, 514, 515, 4221, 4380, 3300, 2117, 7145, 5847, 2968, 1678, 5198, 4766, 457]. **Algebraic-integer** [2366]. **Algebraicznych** [457]. **ALGOL** [578, 734, 757, 578, 491, 539, 272, 410]. **algorism** [4671, 1026]. **Algorithm** [1708, 5234, 1709, 1260, 3959, 4952, 6461, 3035, 3218, 3712, 3849, 1806, 3038, 725, 6849, 5243, 1372, 807, 1492, 2048, 5467, 6357, 6629, 6471, 6741, 1098, 1814,

3398, 4969, 3557, 1497, 5679, 3722, 814, 5683, 1820, 2200, 5260, 3982, 2339, 2059, 1017, 1825, 2869, 5134, 2347, 1831, 3068, 4002, 5696, 6383, 1115, 1835, 428, 4013, 4831, 6150, 5505, 3431, 4846, 3601, 3754, 4029, 4547, 4031, 4200, 4201, 6519, 2381, 2716, 1617, 5010, 5718, 5720, 740, 3447, 972, 5518, 2090, 5734, 1630, 1873, 5306, 3288, 2735, 828, 6890, 5917, 6073, 3457, 313, 5311, 5312, 4060, 2421, 5035, 1048, 5601]. **Algorithm** [2105, 569, 2107, 262, 640, 4725, 2113, 6901, 762, 2947, 1649, 1890, 2115, 2254, 5332, 2566, 6186, 6426, 1654, 1897, 4411, 2774, 2960, 4413, 1532, 1661, 2777, 2778, 3660, 5996, 4896, 5426, 5760, 1157, 2589, 6102, 4902, 923, 2139, 924, 7049, 775, 4610, 1243, 2015, 5630, 6004, 372, 3815, 4113, 3184, 4118, 4448, 5087, 1693, 6207, 456, 4456, 2822, 3518, 2155, 489, 5554, 5775, 5859, 5947, 595, 3698, 1478, 244, 3206, 3531, 5106, 4279, 2630, 1710, 603, 2173, 2040, 4782, 6462, 3549, 3850, 5239, 6356, 3399, 1582, 1720, 4801, 2661, 2662, 3403, 5127, 3229, 2669, 2507, 3980, 3567, 3412]. **algorithm** [5688, 3726, 3415, 3238, 4332, 4333, 3870, 3871, 6254, 3578, 3070, 465, 4682, 4684, 4992, 4008, 3579, 1204, 5285, 4835, 2215, 5817, 5702, 6260, 1971, 3884, 4194, 3257, 3436, 3437, 4199, 2899, 514, 515, 2715, 4032, 3889, 5908, 4708, 5017, 2398, 748, 5736, 2732, 2733, 5165, 2550, 2736, 6680, 5830, 4566, 3459, 4569, 4570, 3627, 3778, 5038, 2937, 2246, 5836, 573, 4878, 761, 577, 1762, 2948, 4881, 5047, 1891, 983, 5417, 5990, 3305, 6319, 2776, 5845, 3145, 5538, 2779, 2967, 1907, 2968, 2448, 4740, 5425, 2131, 2583, 4601, 4746, 4906, 997, 1064, 3336, 3176, 3684, 3513, 1922, 3514, 2602, 293, 1927]. **algorithm** [2811, 3001, 5088, 4763, 5447, 5448, 4276, 3190, 6446, 659, 2483, 3199, 3361, 4770, 5453, 5103, 6010, 3371, 7089, 4941, 6646, 3033, 3550, 2048, 6741, 1192, 2201, 3052, 3053, 3054, 3055, 384, 6042, 1118, 1205, 4996, 5497, 432, 4017, 512, 6390, 564, 2089, 3665, 5440, 270, 2805, 3939, 4440, 5647, 6788]. **algorithm-based** [2246, 3513, 3199, 3361, 3371]. **Algorithmen** [2393, 2231, 2567, 1699, 2300]. **Algorithmes** [4674, 5321, 4341, 2756]. **Algorithmic** [5812, 7458, 3897, 252, 3656, 2796]. **Algorithmics** [7034, 4479, 5083]. **Algorithmique** [5083, 4479]. **Algorithms** [850, 2037, 6615, 4142, 4143, 722, 1805, 3848, 855, 665, 1011, 6848, 7439, 3223, 5380, 5667, 6236, 1265, 1375, 5386, 5388, 1584, 275, 3055, 6245, 3863, 4668, 1105, 5805, 2874, 4519, 4520, 4674, 3243, 4521, 3728, 6039, 1022, 1023, 1024, 1112, 6876, 5397, 3072, 4007, 4173, 6498, 5140, 2071, 2359, 6766, 6767, 5496, 3074, 467, 3738, 736, 823, 877, 6654, 1517, 6049, 5503, 883, 4190, 5150, 2534, 7483, 4198, 4357, 3604, 4546, 3605, 3888, 1519, 1412, 1521, 3273, 4205, 4705, 4706, 3098, 3099, 5725, 2541, 3100, 6167, 6673, 2393, 2231, 4214, 827, 521, 1420, 3899, 7506, 522, 6678, 3111]. **Algorithms** [4557, 3289, 4376, 630, 5828, 5313, 2930, 1528, 4061, 3120, 2933, 3295, 7328, 7448, 1049, 6796, 3636, 1639, 1887, 686, 1640, 690, 1641, 4877, 7206, 7220, 4398, 5044, 4582, 3299, 447, 356, 476, 360, 3643, 5048, 4404, 2567, 3790, 7030, 4408, 1322, 3793, 3315, 1440, 3797, 1443, 4249, 1444, 1770, 5997, 2789, 3802, 7277, 5999, 6810, 5937, 5938, 7265, 6925, 4608, 774, 2456, 3502, 5344, 925, 7052, 7053, 711, 3682, 373, 4112, 1341, 2603, 2812, 2813, 5773, 5858, 3005, 939, 2824, 3828, 1699, 2300, 5557, 3359, 1473, 3367, 7088, 5105, 5374, 551, 3209, 1083, 3548, 5460, 5957, 4496, 4963]. **algorithms** [4308, 5123, 6129, 6234, 6743, 6852, 7228, 2664, 2199, 221, 3859,

1960, 419, 3989, 1827, 1199, 2681, 3060, 3416, 4816, 2205, 1836, 3246, 4681, 6880, 3425, 225, 5142, 5145, 6052, 6387, 7255, 4023, 4701, 5712, 1299, 3269, 5300, 1982, 741, 2918, 4378, 2411, 3116, 4571, 1754, 2422, 3780, 830, 1755, 1882, 1637, 5603, 7362, 7373, 7389, 7402, 7416, 7433, 4066, 2561, 4727, 3131, 2756, 5046, 5181, 2433, 2565, 5183, 5418, 6428, 4077, 5846, 4079, 1442, 1663, 5614, 6193, 2266, 4897, 2452, 4601, 2591, 4089, 3929, 4609, 3166, 3167, 3504, 5346, 2462, 1784, 2023, 5210, 4761, 3000, 1073, 2823, 3191, 492]. **algorithms** [1703, 4934, 5372, 3018, 4942, 2345, 2046, 7206, 7220, 357, 2006, 1061, 1537, 4665]. **Algorithmus** [2046, 384, 2006, 1537]. **Alignment** [5932, 3852, 3916]. **alignments** [1920]. **all-one** [4973]. **Allerton** [7112]. **Alley** [3601]. **allgemeine** [1094, 1210]. **allgemeiner** [1352]. **Allocatable** [3470, 3481]. **Allocation** [6592, 4538, 5736, 4584, 4586, 4457, 3351]. **Alloy** [5839, 5987]. **Almost** [7096, 2279, 5038]. **Alpha** [2985, 3386, 2877, 3507, 3341]. **alphabetical** [101]. **Alps** [6789]. **also** [2961]. **Alternanten** [767]. **Alternate** [4416]. **alternating** [3633]. **Alternative** [1279, 6657, 6535, 6902, 6362, 961, 574, 6323, 4632]. **Alternatives** [4299, 1142, 6419, 3129, 4595, 4711]. **Alto** [7345, 7331]. **ALU** [4293, 5459, 5656, 6386, 2095, 1902, 1659, 5771, 2033, 1798, 2844]. **ALUs** [2166]. **always** [6118]. **am** [1652, 7162, 2609]. **Am25S05** [620]. **Am29000** [2263]. **Am29027** [2263]. **Am29050** [2570]. **Am29C327** [2314]. **Am9511A** [1380]. **Am9511A/Am9512** [1380]. **Am9512** [1270, 1380]. **ambiguity** [4945]. **AMD** [6836, 6501, 4035, 3918, 4077, 3928, 3929, 4091, 4262]. **AMD-K7**^{TM} [4077, 3929]. **AMD5** [3914]. **ameliorating** [1037]. **amélioration** [4308]. **America** [23]. **American** [2039, 7165, 7100, 2855, 31]. **Amherst** [7528]. **Amidst** [6773]. **Among** [1221, 4072]. **amount** [4021]. **Amounts** [3734, 3876, 4003]. **amplifier** [2220]. **Amplifiers** [184]. **Amplifying** [1718]. **Amsterdam** [7468, 7533]. **AN-Codes** [4343]. **AN/UYK** [838]. **AN/UYK-17** [838]. **Anaheim** [7197, 7225, 7253]. **Analog** [462, 111, 4185, 3593, 139, 140, 230, 113, 232, 443, 369, 4092, 132, 150, 4136, 2888, 4844, 4033, 689, 4907, 1687, 3690, 2309]. **Analog-To-Digital** [4136, 4185, 4844, 3690]. **Analogrechenschaltungen** [547]. **analogue** [547, 1063, 3205]. **analogue-to-digital** [3205]. **Analyse** [5684, 40, 7126]. **Analyses** [4348, 3896, 1466, 2814]. **Analysis** [602, 2169, 7147, 152, 4291, 1803, 5117, 7311, 6628, 6465, 4305, 6466, 6235, 3396, 6631, 171, 5679, 5472, 1584, 2331, 2664, 5683, 1588, 2670, 1385, 1017, 6753, 7285, 6137, 3865, 6645, 6980, 6494, 2351, 6381, 6985, 818, 4836, 7179, 112, 5704, 4840, 5706, 5818, 2894, 3083, 6515, 6516, 126, 4547, 2220, 7532, 4035, 6666, 396, 3274, 7202, 2909, 6164, 2389, 397, 627, 2724, 2912, 742, 1138, 1045, 399, 6289, 6682, 3776, 831, 5745, 6179, 6545, 6792, 2746, 1147, 6310, 4399, 355, 913, 5048, 6088, 5333, 2765, 1898, 763, 836, 4886, 2962, 1056, 1661, 4082, 987, 1155, 1906, 4899]. **Analysis** [5762, 1536, 2795, 705, 6811, 7048, 5852, 5343, 5767, 2457, 4268, 784, 38, 42, 3678, 931, 2990, 3510, 1070, 1341, 2812, 2813, 7101, 5211, 6707, 6336, 7087, 2822, 3829, 6599, 1474, 7164, 216, 5225, 7464, 7126, 2845, 2846, 411, 2630, 2170, 5456, 1947, 2040, 3548, 495, 1488, 1089, 1189, 1368, 1807, 2180, 2497, 2181, 4300, 5799, 3717, 1582, 1720, 2662, 3403, 6364, 3050, 40, 422, 1827, 2063, 3061, 6254, 2205, 465, 4684, 4992, 4008, 4688, 505, 3425, 3583, 225, 510,

6045, 5813, 4998, 5145, 2371, 2706, 7180, 3595, 2219, 308, 824, 2079, 1744, 3265, 3266, 5719, 5300, 1982]. **analysis** [5721, 7136, 5908, 3279, 472, 3282, 6068, 628, 3283, 747, 1224, 519, 1225, 1226, 4378, 6411, 3773, 1882, 1637, 524, 571, 2246, 4237, 1647, 1648, 5532, 5047, 5329, 363, 403, 2440, 2117, 2954, 2955, 835, 3143, 984, 2959, 3144, 3800, 4252, 989, 2264, 2266, 368, 1158, 4425, 2586, 2591, 6197, 5941, 3930, 840, 3171, 3172, 3339, 3505, 1065, 5199, 1546, 3344, 3688, 2291, 1924, 375, 3821, 3822, 4449, 1175, 7235, 2825, 3191, 1251, 715, 794, 3007, 5641, 1703, 3834, 1182, 2624, 3837, 6646, 1816, 7263]. **Analysis-Based** [4899]. **Analytic** [3392, 7133, 7133]. **Analytical** [1723, 5701, 191, 16, 5175, 15, 6185, 6424]. **Analytics** [6395]. **Analyzed** [6676, 692, 693, 694, 760]. **Analyzer** [313]. **analyzers** [2370]. **Analyzing** [2382, 6809]. **Anatomy** [3493]. **Anchored** [6477, 6305]. **Ancient** [5796, 6473, 599]. **Andrews** [7378]. **Angeles** [7093]. **Angewandte** [7155, 7154]. **Angle** [2381]. **Angles** [4209]. **angular** [84]. **ANL** [439]. **Ann** [7156, 7290]. **Anniversary** [7301]. **Annotated** [5668, 1235]. **Announcements** [3843]. **Annual** [7146, 7296, 7308, 7354, 7465, 7482, 7254, 7112, 7148, 7239, 7425, 7467, 2072, 7155, 7213, 7245, 7269, 7442, 7304, 7337, 7404, 7463, 7479, 7435, 7376, 7122, 7127, 7379, 7165, 7200, 7124, 7152, 3759, 7261, 7461]. **Annuities** [4258]. **Anomalies** [1869]. **Anomalous** [39]. **ANOVA** [5623]. **ANR** [6374]. **ANSI** [6489, 1860, 1861, 4084]. **ANSI/IEEE** [6489, 1860, 1861]. **Answer** [1353]. **Anti** [51]. **Anti-Aircraft** [51]. **Anticipation** [4435, 5045]. **Anticipator** [5558, 4679, 2535]. **anticipators** [6082]. **anticipatory** [3796, 3689]. **Antikythera** [5897]. **antilogarithmic** [4635, 5474]. **Antitrust** [5353]. **Anton** [5544]. **Antonio** [7261]. **ANTS** [7458]. **ANTS-VII** [7458]. **Anwendungen** [1975]. **Anwendungsgebiete** [1484]. **anwendungsorientierten** [1236]. **Any** [5685, 1222, 6604, 6458, 4504, 4505, 4366]. **Anyway** [6709]. **AOP** [4555, 4859]. **AP** [1120, 7358]. **AP-120B** [1120]. **AP-ASIC** [7358]. **Apache** [5634]. **APL** [699]. **APMathLib** [4481]. **App** [6352]. **Apparatus** [612, 4336, 4001, 6283, 6549, 3852, 4021, 3883, 4024, 3748, 3916, 2118, 3693, 3365]. **Appearance** [3886]. **Apple** [4516, 5327, 1161]. **APPLESOFT** [1010, 1085, 1336]. **Applicability** [1708, 6362]. **Application** [5454, 3962, 4296, 6628, 859, 1013, 6466, 3557, 7299, 7312, 7499, 6640, 7285, 40, 6644, 3996, 4328, 4817, 7411, 7456, 3576, 509, 3251, 4198, 6518, 563, 3442, 7259, 7429, 7445, 7470, 7484, 7493, 1134, 6537, 3770, 5034, 3294, 1640, 4582, 4583, 4588, 2569, 2573, 6430, 1236, 6196, 7405, 3676, 1781, 7377, 5773, 1929, 7338, 4925, 2823, 6710, 7451, 7295, 6979, 2633, 5868, 950, 6230, 4300, 2655, 1268, 6880, 4180, 2369, 2703, 7255, 3268, 3269, 2722, 5910, 1226, 4711, 6291, 5922, 2761, 3316, 5933, 2793, 4087, 2592, 3159, 2598, 5083, 108, 3000, 3692, 6338, 1471, 1472, 4477, 2309]. **Application-Oriented** [1236]. **Application-Specific** [6628, 7499, 7411, 7456, 7429, 7470, 7484, 7405, 7377, 7338, 6710, 7451, 7295, 7445, 7493, 6979, 2633, 6338]. **Applications** [6833, 6952, 4948, 6217, 7284, 7309, 7340, 4295, 4492, 1571, 5871, 7454, 7468, 4651, 5379, 7394, 1718, 955, 1957, 6132, 7410, 6638, 6369, 6858, 3572, 3730, 3999, 4338, 5695, 2685, 6985, 6877, 2208, 3423, 6384, 6042, 6772, 305, 1741, 1848, 6995, 557, 5150, 4353, 4355, 6777, 7343, 1300, 1409, 1617, 7135, 7151, 7233, 7492, 1305, 5161, 6785,

7326, 5304, 4370, 2921, 5167, 1139, 5409, 312, 7218, 6539, 6540, 6891, 6543, 7018, 5834, 4577, 1432, 4876, 6311, 6693, 4889, 7306, 2128, 3801, 4422, 5196, 7173, 6434, 1539, 372, 2289, 1553, 6937, 7126, 6609, 4813, 7296, 6949, 1185, 3022]. **applications** [1485, 2312, 5956, 3220, 1490, 4151, 7382, 7228, 5681, 2056, 5880, 2335, 1727, 3417, 3729, 6648, 2684, 6254, 1839, 2365, 5142, 4698, 4023, 5005, 6508, 4196, 5716, 7080, 5976, 6402, 3103, 3450, 748, 2415, 7290, 2932, 7204, 2558, 2942, 316, 4886, 4592, 3148, 2585, 5764, 7161, 5942, 3501, 3511, 2018, 790, 455, 17, 3190, 7280, 1351, 5779, 1704, 5371, 1975, 1700, 7126]. **Applied** [7297, 7174, 548, 1194, 3562, 6383, 1128, 7457, 5005, 7517, 7100, 5343, 7192, 7534, 2045, 2319, 2710, 3613, 7457, 7427, 7514]. **Applying** [2857, 333, 3888, 5329, 5328, 2568]. **Approach** [6733, 6020, 4146, 3392, 4313, 1723, 1103, 5263, 3574, 6495, 5278, 6499, 5811, 1840, 5700, 736, 6155, 5511, 7243, 7324, 7396, 7513, 6516, 5401, 3888, 5516, 5592, 1137, 7170, 1992, 6902, 1438, 1154, 7247, 4422, 2130, 1450, 3162, 3678, 7068, 6344, 5562, 3376, 3377, 1079, 1184, 2177, 2044, 1269, 961, 5274, 2698, 2922, 634, 3773, 2553, 2249, 6085, 6185, 6424, 2954, 3656, 2586, 5764, 3333, 5345, 2999, 1351, 1938]. **Approaches** [1086, 6711, 3323]. **Approaching** [2183]. **Approved** [6523]. **Approximate** [6613, 6833, 5955, 6120, 6958, 6132, 5483, 156, 6873, 6381, 1124, 6991, 6259, 6266, 6774, 557, 6776, 6166, 3762, 6534, 6888, 6791, 6301, 6420, 6545, 6792, 6896, 690, 6310, 6423, 1650, 6088, 6688, 6907, 7029, 6802, 6913, 6434, 6438, 6699, 7066, 6821, 6599, 6937, 6940, 6941, 7088, 6944, 7072, 6949, 4151, 282, 3268, 4117]. **Approximated** [5666, 6856]. **Approximating** [2390, 3307, 2783, 4096, 2980, 3718, 5009, 5291, 3616, 2426, 5188, 3018]. **Approximation** [3956, 6461, 2052, 6748, 5476, 6640, 6642, 1018, 4818, 2685, 427, 623, 6883, 7078, 3444, 3445, 6527, 4214, 6177, 6795, 5064, 320, 527, 4093, 3810, 3676, 3934, 4105, 4111, 5946, 6109, 2610, 5098, 6007, 6606, 1377, 221, 3573, 5488, 5141, 425, 2361, 5142, 3758, 2911, 3102, 6894, 7022, 4237, 7206, 7220, 3138, 983, 3301, 2118, 7044, 1681, 3168, 5197, 5784, 1834, 7144]. **Approximationen** [513]. **Approximations** [1259, 5382, 6359, 6972, 1021, 2068, 2206, 280, 2690, 383, 426, 2893, 469, 470, 119, 3600, 513, 6885, 4375, 2549, 908, 2949, 2000, 1765, 579, 768, 1162, 3808, 3809, 4098, 240, 241, 271, 532, 7067, 168, 596, 3016, 2174, 5250, 5251, 5139, 5491, 251, 3751, 4037, 4038, 688, 4729, 1057, 481, 1453, 3336, 4110, 2837]. **Apps** [6692]. **Apr** [6523]. **April** [7127, 7226, 7422, 7111, 7425, 7310, 7394, 7186, 7457, 7181, 7193, 7273, 7398, 7413, 7460, 7503, 7510, 7515, 7202, 7136, 7361, 7100, 7171, 7330, 7337, 7351, 7404, 7463, 7479, 7133]. **Aptitude** [1699]. **Ara** [6636]. **Arabia** [2863]. **Arabic** [5532, 101, 6911, 407]. **Arb** [6066, 6280]. **arbitraire** [3971, 4480]. **Arbitrarily** [437, 2797, 844, 6671, 6672]. **Arbitrary** [2051, 4968, 5381, 1101, 962, 428, 5586, 6280, 6528, 2100, 3771, 6174, 6297, 6417, 5046, 3141, 2789, 1774, 4602, 4603, 4429, 650, 588, 932, 4113, 3697, 4480, 4494, 6734, 3971, 4795, 1597, 1730, 5977, 5826, 7024, 1329, 6321, 2140, 2830, 5111]. **Arbitrary-accuracy** [6417]. **Arbitrary-Precision** [6280, 6528, 6174, 6297, 4113, 4480, 5977, 7024, 6321]. **Arbor** [7156, 7290]. **Architect** [4386]. **Architectural** [7226, 4318, 5812, 4699, 1417, 5929, 2304]. **Architecture** [7146, 6836, 3955, 4777, 5566, 2491, 5113, 6349, 7148, 4952,

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2649, 2864, 5875, 6629, 6739, 6740, 6967, 5124, 3046, 1717, 5669, 6237, 6472, 6026, 728, 809, 861, 1097, 1098, 1099, 1192, 1264, 3972, 5670, 1375, 4312, 2866, 196, 6974, 7489, 5672, 6475, 7142, 2329, 6634, 7383, 7524, 4316, 1194, 23, 2195, 171, 2053, 2054, 1721, 5472, 3559, 2198, 6365, 612, 6977, 668, 1821, 669, 867, 1381, 1586, 1382, 6368, 1383, 6749, 6750, 2058, 1272, 6369, 730, 1502, 1725, 1824, 2339, 2671, 3053, 1386, 1590, 2059, 3984, 4160, 4161, 4665, 6245, 1197, 1198, 1274, 1726, 5883, 3990, 5261, 5482, 7531, 2060, 4977, 6487, 4320]. **Arithmetic** [4670, 4978, 6030, 6861, 6862, 6863, 6864, 6865, 6866, 223, 1106, 224, 7356, 3234, 276, 1275, 1505, 3571, 4326, 6755, 5805, 4982, 5484, 2678, 2204, 5885, 617, 869, 4814, 1506, 4168, 6760, 6037, 6140, 5267, 870, 6493, 3728, 3732, 4339, 3067, 2883, 1967, 5580, 4004, 5396, 4824, 1833, 6382, 1113, 2208, 2356, 7230, 4827, 136, 174, 199, 157, 6879, 6498, 3248, 5810, 4009, 1395, 1278, 6766, 6767, 6987, 962, 1203, 12, 1838, 4178, 4179, 6988, 250, 1737, 5496, 6989, 6500, 281, 509, 3426, 3582, 3073, 1279, 674, 5584, 6044, 5585, 1605, 1123, 4343, 4530, 554, 387, 964, 5499]. **Arithmetic** [5500, 823, 4018, 3741, 5971, 880, 6654, 2528, 2700, 2701, 3587, 4534, 4697, 5816, 5398, 6258, 555, 1128, 1033, 1285, 3881, 5502, 1401, 1286, 4349, 882, 5705, 306, 4843, 2705, 389, 1404, 1849, 4699, 1210, 1289, 3589, 6152, 6995, 4352, 3591, 6154, 6156, 6262, 6263, 6264, 6265, 7529, 7536, 6996, 7538, 1613, 679, 338, 339, 340, 559, 4026, 1035, 1293, 3886, 2898, 2710, 3753, 4543, 6514, 4198, 4357, 6271, 6392, 6517, 6778, 6884, 3756, 4703, 5293, 5401, 1978, 4850, 6272, 1130, 6273, 6395, 1300, 1409, 4550, 1131, 1301, 2085, 4360, 517, 1132, 1216, 1521, 1858, 7187, 1745]. **Arithmetic** [1980, 2539, 3890, 7125, 7129, 7139, 7156, 7169, 1861, 1862, 2086, 7446, 7515, 6064, 6523, 7535, 7537, 7539, 5159, 5299, 342, 6885, 4141, 1413, 7201, 6274, 5402, 2909, 6525, 1983, 437, 6782, 5731, 5909, 6277, 1625, 3101, 5519, 6280, 1626, 5979, 6167, 6281, 6282, 6673, 6784, 1747, 4040, 3612, 1416, 1986, 2723, 4211, 4853, 5015, 742, 745, 346, 3763, 5018, 20, 5591, 7260, 886, 4555, 4372, 827, 3767, 2096, 3109, 891, 1872, 6677, 2731, 3454, 7317, 1633, 4219, 5823, 3111, 7361, 4052, 4220, 4557, 1043, 1138, 1424, 1753, 2099, 2410, 7262, 5307, 5308, 7476, 5524, 5597, 5738, 5825, 5980, 3114, 3770]. **Arithmetic** [751, 893, 4054, 894, 1044, 1045, 898, 1309, 1992, 4562, 5409, 5914, 6538, 6787, 5915, 3903, 6290, 901, 1879, 3772, 7336, 6293, 5172, 33, 2103, 4058, 4386, 4568, 6175, 6298, 6542, 233, 286, 350, 7013, 7014, 3294, 4061, 2931, 7016, 1141, 4228, 288, 1144, 5745, 6303, 7020, 3295, 6304, 1884, 441, 572, 1885, 6546, 2554, 2934, 2935, 2936, 3463, 3631, 4871, 181, 3632, 7477, 4577, 2746, 2938, 3464, 2555, 5528, 3635, 978, 686, 442, 1761, 1640, 1432, 1641, 3640, 4876, 7023, 6794, 525, 691, 910, 1314, 1888, 4725, 5531, 4582, 446, 4238, 4879, 6901, 5606, 3470, 5414, 4239, 912]. **Arithmetic** [4583, 162, 289, 355, 358, 144, 102, 3472, 5839, 1650, 1054, 6316, 6317, 6559, 6560, 5535, 4728, 7449, 7523, 6183, 6904, 6184, 4404, 1653, 4588, 3141, 2763, 4406, 5611, 5842, 7519, 6425, 6905, 5992, 6799, 6906, 7028, 7030, 145, 1655, 914, 5993, 6694, 1657, 1900, 478, 3478, 3650, 764, 5186, 3651, 3795, 6912, 6913, 2962, 1154, 2121, 2122, 3315, 4414, 1440, 1660, 2123, 7039, 6919, 3797, 1058, 1324, 1904, 2124, 4249, 6098, 6565, 4253, 121, 5422, 2, 7329, 6918, 701, 2130, 6804, 6805, 2785, 4258, 209, 3488, 6568, 2789, 5194, 1446, 4424, 5196, 3926, 1671, 1672, 4599]. **Arithmetic** [482, 582, 583, 1447, 6698, 5433, 1237,

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1889, 4882, 2555, 94, 6550, 1759, 639, 686, 2557, 5926, 3639, 979, 6422, 1640]. **Floating** [2753, 7023, 1642, 6181, 3127, 5837, 6795, 4579, 525, 576, 910, 1147, 3784, 5751, 402, 2562, 1148, 4399, 6901, 6311, 1998, 6312, 3471, 3136, 5607, 4400, 7026, 7084, 982, 2253, 5533, 5326, 3787, 449, 5988, 5989, 6315, 6316, 6317, 6559, 6560, 362, 2432, 5535, 1531, 1763, 6184, 641, 1895, 2116, 2256, 2436, 2437, 3141, 5051, 5611, 6186, 6425, 1437, 3915, 1151, 2117, 2765, 7036, 4407, 2443, 2444, 6427, 6563, 6691, 5929, 915, 5058, 5930, 5995, 3791, 5185, 5334, 7035, 3481, 2774, 4078, 3651, 3653, 3655, 3794, 3795, 4077, 5061, 2569, 2962, 2570, 5932, 4414, 2777, 2778, 5420, 7038]. **Floating** [2003, 644, 1058, 1324, 2573, 2262, 4253, 6192, 645, 6697, 1156, 1234, 1326, 5934, 5996, 5615, 2127, 7042, 701, 4256, 4422, 5997, 2266, 2785, 2786, 3152, 2007, 6568, 5540, 837, 2789, 2973, 1772, 6101, 2582, 3155, 4899, 5616, 5427, 5428, 2008, 6432, 6433, 2272, 991, 2976, 2273, 1238, 3669, 921, 922, 6195, 2274, 993, 3158, 2275, 4605, 5617, 2276, 6197, 2797, 5068, 5436, 5437, 5619, 5939, 4262, 6700, 6438, 1540, 6329, 1679, 453, 1680, 6330, 3931, 3932, 5070, 1543, 4094, 2594, 1454, 1775, 4910, 5072, 5344, 2282, 4102, 4268, 4438, 4752, 5073, 5768, 7052, 4612, 5075, 2983, 1685, 7057, 1776, 5629]. **Floating** [5854, 2595, 3680, 4914, 2461, 269, 212, 2147, 2984, 2017, 5771, 1546, 2463, 787, 1686, 2805, 2990, 3178, 3179, 3180, 3342, 3685, 3686, 2287, 5944, 6205, 6930, 7062, 3343, 6106, 6107, 6580, 2020, 2021, 1689, 1690, 2995, 5945, 2601, 4915, 5203, 5204, 5205, 5206, 5441, 5442, 5443, 5444, 5445, 2809, 2996, 843, 1338, 1458, 1459, 1785, 5546, 3941, 3942, 5086, 1340, 2291, 4113, 2025, 5857, 4271, 6206, 3944, 1786, 5548, 2470, 2607, 2608, 3002, 5089, 5090, 1465, 5549, 6707, 1789, 5213, 5357, 3517, 4922, 6109, 6593, 4121, 592, 3347, 4455, 6336, 7065, 6005, 7066, 6443, 1072, 5358, 2027]. **Floating** [3827, 848, 5359, 5550, 2822, 3190, 3518, 2824, 6709, 3350, 6337, 2826, 2827, 1349, 5093, 1075, 5551, 5859, 3695, 1350, 3830, 3193, 6211, 6444, 6445, 2299, 3948, 215, 6345, 1469, 1701, 2617, 1702, 5099, 5222, 5366, 5367, 5558, 5559, 5640, 5643, 6447, 1556, 1354, 1471, 1472, 1473, 1474, 3952, 2033, 5780, 7069, 2034, 3011, 3012, 5949, 216, 3201, 2302, 6213, 2836, 4281, 6114, 134, 1797, 5225, 5950, 2625, 799, 1357, 3019, 1706, 3529, 5373, 5783, 4136, 948, 1941, 6714, 6828, 6829, 5952, 6608, 5106, 5562, 5647, 5107, 5374, 5231, 6610, 5578, 5692, 5886, 4624, 6340, 4279, 1937, 2172, 3375]. **floating** [5375, 662, 2851, 1943, 1944, 6449, 3957, 1564, 5650, 6215, 3023, 3705, 3842, 5455, 5456, 6015, 6118, 6016, 720, 296, 1485, 2492, 2634, 3029, 3214, 3380, 3381, 3382, 3383, 4488, 6351, 6458, 6459, 6956, 2493, 1085, 1010, 5655, 1800, 2312, 1801, 1802, 1362, 2314, 1569, 1570, 2041, 2315, 4782, 6122, 4145, 1487, 2496, 2861, 3037, 5568, 5873, 2043, 1368, 1807, 2180, 2497, 2181, 5874, 4300, 2045, 2319, 6961, 2643, 3221, 3039, 2320, 4303, 5241, 5242, 1091, 2182, 1370, 2323, 5799, 4786, 2498, 1190, 5122, 3852, 2324, 6232, 2325, 2186, 2646, 2647, 3045, 1813, 4308]. **floating** [4503, 4653, 4789, 4790, 4791, 5123, 5245, 5959, 6234, 3717, 1716, 299, 2187, 666, 5248, 5570, 4311, 3853, 1015, 4794, 5383, 5571, 6969, 6970, 7076, 2188, 1016, 1193, 6360, 5803, 6633, 3226, 4971, 3556, 1815, 2190, 2656, 6362, 1954, 6478, 1377, 6479, 3401, 6241, 1378, 4801, 4972, 2661, 3228, 379, 1585, 6364, 3856, 4975, 1818, 2056, 2665, 3723, 3858, 5880, 1380, 1722, 2200, 2335, 4509, 5478, 3979, 3980, 5962, 4803, 4804, 3983, 1589, 5480,

5686, 6135, 4162, 2674, 1104, 1961, 3989, 4671, 4516, 421, 5483, 3412, 5688, 2342, 2870, 2871, 2872, 3866, 3995, 3237, 6251, 2679, 6252]. **floating** [5392, 5393, 959, 1276, 2681, 6374, 5965, 5693, 3059, 2878, 3241, 3416, 4522, 4676, 4816, 6139, 6037, 3998, 3061, 249, 4820, 5136, 5266, 4336, 961, 4525, 5579, 6648, 5138, 2516, 5271, 2517, 4985, 2348, 4169, 2882, 5272, 2205, 502, 1733, 1734, 2884, 4001, 1202, 5274, 5139, 5491, 734, 1116, 4991, 4174, 4175, 6880, 4686, 4687, 5582, 1512, 1968, 2360, 1736, 1969, 819, 508, 3737, 1204, 5281, 1029, 6257, 2890, 2364, 4834, 6653, 4693, 5813, 4694, 282, 3076, 3252, 4696, 4837, 3077, 2526, 621, 879, 1030, 1208, 1283, 1739, 3428, 2892, 3078, 1031, 2702, 1843, 5501, 1844, 2530]. **floating** [1845, 5702, 2370, 4840, 4841, 1846, 5399, 5974, 6051, 6504, 1287, 2371, 252, 178, 3882, 2375, 1850, 4351, 4844, 3883, 2532, 4022, 6660, 6661, 3080, 4023, 5003, 3593, 5819, 6997, 4024, 4540, 4700, 6508, 2894, 2895, 3595, 6391, 3083, 3434, 3596, 1291, 1407, 1213, 1974, 3598, 2219, 3435, 1408, 1297, 3260, 3090, 4030, 2220, 4548, 2900, 2535, 3091, 2711, 5294, 5295, 1744, 2903, 6396, 6521, 6665, 5716, 2084, 5717, 516, 826, 1215, 2383, 5719, 681, 2385, 1218, 1863, 1746, 3275, 3608, 5157, 5158, 5160, 5514, 2223, 2224, 4034, 4551, 3607, 1133, 1219, 1866, 2386, 4707, 5905, 2906, 4553, 5727, 5728]. **floating** [1624, 3278, 5976, 6165, 6278, 6279, 6402, 201, 2088, 3611, 5977, 6406, 2227, 2911, 3102, 3279, 5978, 2229, 2395, 2396, 2230, 3103, 2092, 2093, 3449, 3614, 3615, 4210, 4212, 5733, 4709, 2915, 3281, 3451, 3617, 3282, 6068, 628, 473, 744, 2399, 2400, 2401, 2402, 746, 747, 1224, 2235, 2097, 1632, 311, 520, 4860, 4861, 2734, 1225, 1226, 2406, 2408, 2409, 1751, 1874, 1527, 1752, 5596, 6786, 3623, 3901, 4378, 3115, 3290, 4864, 5598, 2924, 3456, 5309, 829, 897, 973, 1993, 4222, 5916, 6072, 4865, 2551, 3292, 899, 975, 2926, 7012, 2241, 2242, 5918, 6411, 6291, 3904, 3905, 5829]. **floating** [5173, 7081, 6176, 755, 2741, 2928, 3117, 4567, 5832, 6078, 5981, 5922, 4869, 3777, 4392, 4573, 351, 4575, 3908, 4870, 524, 571, 5602, 1757, 5320, 3630, 5603, 5924, 1638, 5322, 5323, 4230, 5985, 4872, 6549, 2247, 1050, 1995, 1313, 2941, 3637, 573, 640, 757, 758, 401, 688, 689, 574, 5986, 2249, 4874, 1996, 1997, 980, 909, 3126, 1434, 2561, 4580, 4724, 6085, 3129, 2251, 2114, 2756, 5045, 2252, 5325, 3135, 6686, 7025, 1646, 1647, 1648, 695, 2563, 5752, 5840, 3473, 5327, 4881, 5047, 5329, 5330, 5331, 5415, 5534, 6903, 2564, 1999, 3914, 5050, 5417, 319, 1894, 2255, 2435, 2438, 2762]. **floating** [3647, 5991, 2954, 2955, 917, 7032, 2441, 2442, 984, 4243, 3309, 4731, 2259, 3144, 6189, 3310, 3311, 3920, 2446, 3796, 4890, 6914, 3316, 580, 4891, 5335, 5846, 6191, 480, 4245, 3146, 3147, 5336, 5538, 6097, 5847, 985, 4248, 4083, 4251, 5758, 765, 986, 3799, 4084, 7041, 4737, 3323, 6099, 4894, 1327, 2004, 5759, 2263, 208, 700, 989, 2264, 2968, 2265, 3801, 7043, 2267, 2579, 3325, 526, 7044, 3492, 2268, 7091, 2583, 2791, 2975, 4900, 2271, 3328, 4087, 5762, 2451, 2586, 2795, 2587, 2588, 1773, 2135, 1332, 5065, 6809, 992, 528, 1240, 1241, 1333, 706, 1062, 2977, 1063, 3329, 1677, 483]. **floating** [4906, 3496, 773, 5936, 5621, 5622, 5849, 6200, 5765, 3928, 3929, 4091, 1336, 4907, 4607, 1913, 3159, 107, 5766, 5625, 6439, 997, 2978, 2457, 3930, 5626, 3672, 3332, 776, 2013, 2279, 2593, 2141, 7051, 4908, 6003, 709, 710, 3170, 3811, 4103, 4751, 5543, 2459, 3933, 4439, 4912, 4913, 5769, 3935, 3677, 2799, 2800, 2981, 2982, 2801, 3339, 3175, 2284, 3679, 3813, 4613, 926, 3176, 3505, 2016,

3506, 1065, 3937, 5199, 4110, 4440, 6703, 3814, 2466, 1688, 1921, 2994, 4615, 2288, 1169, 2467, 2468, 4441, 4442, 4617, 5080, 5081, 5082, 5207, 5208, 5349, 5350, 5351, 5352, 1784]. **floating** [1460, 292, 1461, 2024, 4759, 3689, 4116, 375, 323, 4761, 845, 2817, 2818, 3186, 3187, 5088, 1928, 3690, 147, 1464, 1787, 1930, 2294, 1934, 1788, 3003, 5212, 6334, 3004, 1696, 846, 3346, 4452, 4923, 1071, 3348, 1346, 4122, 4277, 7087, 1791, 3692, 1792, 1697, 1936, 4125, 4278, 2029, 941, 6338, 4926, 4927, 715, 794, 3693, 1793, 2615, 2476, 2478, 4458, 4459, 2031, 5220, 1351, 2829, 2160, 492, 3196, 2481, 849, 3950, 2484, 3007, 4768, 4932, 5221, 5368, 5779, 6212, 2485, 1795, 1703, 1355, 1796, 540, 541, 542, 2162, 2301, 5100, 795, 2486, 2487, 1255, 294, 1704, 2163, 3202]. **floating** [3365, 1938, 1559, 2304, 2488, 1356, 2621, 4129, 1798, 1560, 4935, 5227, 5561, 5781, 947, 2624, 4131, 4282, 4936, 4937, 5782, 598, 797, 2841, 6943, 194, 2843, 2307, 2489, 2845, 2846, 3205, 3837, 7089, 5229, 4942, 4943, 5108, 5110, 4634, 4774, 4775, 2309, 6720, 6948, 5132, 2345, 2682, 1252, 6469, 1731, 3892, 4867, 1884, 3644, 3188, 2298, 2299, 2300, 2479, 2480, 1475, 5577, 995]. **floating-** [5375, 5880]. **Floating-Decimal** [134]. **Floating-Point** [2039, 6957, 3955, 2629, 4637, 4947, 5235, 5787, 5564, 4638, 6953, 4948, 3959, 6453, 6954, 6217, 4643, 5116, 6350, 6352, 6621, 6955, 5653, 5654, 5793, 5794, 5870, 6733, 4958, 3388, 3966, 4147, 4148, 4149, 1949, 4497, 2322, 6736, 2499, 3716, 5665, 860, 1014, 1094, 2047, 2649, 2864, 5246, 5667, 5875, 6023, 6024, 6025, 6357, 6739, 3396, 3397, 2050, 6026, 2501, 2051, 727, 2328, 5877, 6130, 1266, 1267, 1376, 4313, 6361, 6632, 6975, 3555, 6477, 5470, 247, 864, 5678, 3227, 3402, 5126, 6636, 2659, 1583, 5572, 2663, 3561, 4318, 5473, 5804, 6856, 1270, 6243, 730, 1385, 1502, 1725]. **Floating-Point** [2339, 3053, 3984, 6134, 3986, 1198, 1274, 1726, 5883, 3863, 3990, 5129, 5261, 5481, 5482, 2869, 4321, 3410, 3411, 3570, 2061, 6141, 6137, 4326, 6755, 2513, 2514, 6645, 4328, 4814, 616, 5889, 5890, 6035, 6760, 6873, 5269, 5137, 6494, 4339, 1965, 2065, 6143, 3875, 1732, 2883, 2885, 5396, 504, 6651, 4527, 5277, 5493, 3421, 4007, 4173, 1837, 6146, 2211, 1278, 6766, 6767, 1511, 6147, 4179, 6988, 2213, 6500, 4995, 5811, 1279, 2214, 2889, 4529, 5698, 3739, 1970, 5499, 877, 4019, 880, 1284, 6772, 2700, 2701, 4697, 5398, 5902, 6258, 6655, 1402, 1609, 6656, 4348, 4537]. **Floating-Point** [5504, 306, 2217, 2218, 2372, 1849, 4185, 6995, 5708, 6774, 4845, 969, 391, 392, 5289, 3885, 2534, 6776, 5587, 1975, 970, 6517, 2538, 2712, 2902, 6158, 6273, 1300, 5298, 5820, 3888, 1131, 6161, 1618, 6522, 1860, 1861, 1862, 2086, 2087, 6523, 5159, 5723, 6667, 3096, 3097, 4202, 342, 5588, 6065, 5906, 5518, 5729, 5731, 5907, 5909, 6277, 6403, 4364, 3893, 5519, 1221, 6167, 6281, 6673, 1627, 5912, 6168, 344, 1223, 1307, 1416, 1986, 2913, 3760, 3894, 3895, 4211, 4365, 4554, 4853, 4854, 5015, 5405, 4368, 3762, 742, 745, 7006, 5302, 1870, 2545, 6532, 890, 1041, 3287, 5522, 827, 2407, 2921, 5307]. **Floating-Point** [5308, 5825, 3769, 750, 751, 893, 1045, 5915, 3291, 6539, 6540, 6891, 6892, 6289, 6171, 6294, 6077, 5030, 2742, 6173, 4868, 5033, 6174, 6297, 6542, 1528, 440, 5316, 5317, 7015, 7017, 2105, 5176, 5983, 831, 904, 1430, 570, 5744, 6179, 3295, 2934, 2935, 2245, 2424, 6305, 2746, 4882, 2555, 6550, 639, 686, 2557, 5926, 6422, 1640, 2753, 7023, 5837, 6795, 4579, 525, 576, 1148, 3471, 5607, 4400, 7026, 7084, 982, 5533, 5326, 2432, 5535, 1763, 6184, 641, 1895, 2116, 2256, 2436, 2437, 3141, 5051,

5611, 6186, 6425, 1151, 2765, 2443, 2444, 6427, 6563, 6691, 915, 5058, 5185]. **Floating-Point** [5334, 2774, 4078, 3653, 3655, 3794, 2962, 5932, 2777, 2778, 5420, 7038, 2003, 644, 1324, 2573, 2262, 6697, 5996, 7042, 701, 4256, 5997, 2785, 2786, 3152, 6568, 5540, 4899, 5616, 5427, 5428, 6433, 2272, 2273, 1238, 3669, 921, 922, 6195, 2274, 993, 3158, 2275, 4605, 2276, 2797, 5068, 5436, 5437, 5619, 5939, 6700, 6438, 1680, 6330, 3932, 1543, 4094, 1454, 1775, 4910, 5072, 5344, 4438, 4752, 5073, 5768, 7052, 5075, 2983, 7057, 5629, 5854, 3680, 2461, 212, 2984, 2805, 2990, 3178, 3179, 3342, 3685, 3686, 2287, 5944, 6205, 6930, 7062, 6106, 6107, 6580, 2020, 2995, 2601, 4915, 1458, 1459, 1785]. **Floating-Point** [5546, 5086, 1340, 5857, 1786, 5548, 2470, 2607, 2608, 3002, 1465, 5549, 6707, 1789, 3517, 4922, 6109, 6593, 4121, 592, 3347, 6336, 6005, 7066, 5358, 2027, 848, 5550, 2822, 3518, 2824, 6709, 3350, 6337, 5859, 3830, 3193, 6211, 6445, 2299, 215, 1469, 1701, 2617, 5099, 5222, 5366, 5367, 5558, 5559, 5643, 1354, 2033, 3012, 216, 3201, 2302, 6213, 5225, 2625, 799, 3019, 1706, 5373, 4136, 6828, 6829, 6608, 5106, 5562, 5647, 5107, 5374, 5231, 6610, 5692, 5886, 4624, 6340, 4489, 6951, 4484, 2170, 2171, 416, 3215, 1947, 4297, 6467, 2326, 6966, 6967, 1578, 1579, 1718, 5251, 6474, 4796, 4970, 2503]. **Floating-point** [6363, 2666, 2667, 2668, 5961, 6028, 1501, 1824, 2202, 2062, 3726, 5267, 4679, 1394, 4688, 2524, 2368, 307, 3745, 5149, 1296, 5513, 1298, 3891, 7002, 4207, 4206, 4039, 3283, 258, 2920, 4560, 895, 6070, 6288, 4565, 4866, 6679, 2417, 6791, 6418, 1759, 3639, 979, 3127, 6901, 6311, 2253, 3915, 2117, 2570, 5615, 2007, 2008, 6197, 3931, 4268, 4914, 2147, 2463, 2291, 2025, 4271, 6206, 7065, 3827, 5359, 3190, 2826, 2827, 1075, 3695, 1350, 6444, 1471, 1472, 1473, 1474, 5950, 6714, 5578, 1937, 2172, 3375, 2851, 3957, 1564, 6215, 5456, 6118, 720, 1485, 2634, 3029, 3380, 3381, 3382, 4488]. **floating-point** [6351, 6458, 2493, 1085, 5655, 1800, 2312, 1801, 1802, 6122, 4145, 2861, 3037, 5568, 5873, 5874, 2319, 6961, 2643, 2320, 4303, 5241, 5242, 2182, 2323, 5799, 4786, 5122, 2325, 2186, 2646, 3045, 1813, 4308, 4789, 4790, 5123, 5959, 6234, 3717, 2187, 5248, 5570, 4311, 1015, 4794, 5383, 5571, 6969, 6970, 2188, 1016, 1193, 6360, 5803, 6633, 3226, 4971, 2190, 6478, 1377, 3401, 4972, 1585, 6364, 4975, 2056, 2665, 3858, 4509, 3980, 3983, 1589, 5480, 5686, 6135, 1961, 3989, 4671, 5483, 2342, 2870, 2871, 2872, 3995, 6252, 5392, 5393, 2681, 6374, 5693, 3059, 4522, 3998, 3061, 249]. **floating-point** [4820, 5136, 5266, 4336, 961, 4525, 5138, 4985, 2348, 4169, 2882, 5272, 502, 1733, 1734, 5274, 734, 1116, 4175, 6880, 1968, 1736, 1969, 819, 508, 5281, 1029, 6257, 2890, 2364, 4834, 6653, 4693, 4696, 4837, 3077, 621, 879, 1030, 1208, 1283, 1739, 3428, 2892, 3078, 1843, 5501, 1844, 2530, 1845, 5702, 4840, 4841, 5974, 6051, 6504, 1287, 252, 178, 1850, 4351, 4844, 6660, 6661, 5003, 3593, 5819, 4024, 4540, 4700, 2894, 2895, 3434, 3596, 1407, 1213, 1974, 3435, 3260, 4548, 2535, 5294, 5295, 1744, 6396, 6521, 6665, 5716, 2084, 5717, 1215, 5719, 2385, 1218, 1863, 1746, 3608, 5158, 5160]. **floating-point** [5514, 2223, 2224, 4034, 1133, 1219, 1866, 4707, 5905, 2906, 5727, 5728, 1624, 5976, 6165, 6278, 6279, 6402, 5977, 2229, 2395, 2396, 3103, 2092, 2093, 3449, 3614, 3615, 4210, 4212, 5733, 4709, 2915, 3281, 3451, 3282, 628, 473, 744, 2399, 2400, 2401, 2402, 4860, 2734, 2406, 2408, 2409, 1527, 1752, 5596, 6786, 3623, 3901, 4864, 5598, 3456, 829, 897, 973, 4222, 5916, 6072, 4865, 2551, 3292,

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4523, 4675, 4817, 5889, 5890, 6035, 6760, 6140, 1964, 6873, 5269, 1731, 5137, 6494, 5394, 3732, 4339, 6763, 1965, 2065, 501, 6143, 3875, 1732, 2883, 2885, 1967, 5396, 504, 1833, 6382, 6878, 6651, 4527, 5277, 5493, 3421, 3736, 4007, 4173, 3248, 5494, 1837, 6146, 2211, 1278, 6766, 6767, 962, 1511, 3422, 1203, 6499, 1513, 6147, 5583, 4179, 6988, 2213, 6500, 4995, 5811, 1279, 2214, 2889, 4529, 2697, 5698, 4344, 3251, 3739, 227, 228, 1607, 1970, 5499, 823, 877, 4019, 880, 1284, 6772, 1740, 2700, 2701, 4697, 965, 5398, 5902, 6258, 6655, 966]. **Point** [1032, 3881, 1402, 1609, 6656, 4348, 4537, 5504, 306, 677, 2217, 2218, 2372, 1848, 1849, 4185, 6995, 5707, 5708, 2707, 6154, 6262, 6263, 6264, 6267, 6774, 4845, 341, 969, 391, 392, 3432, 4026, 4188, 4189, 5289, 3885, 6509, 2534, 1035, 3599, 3085, 6776, 5587, 1615, 1975, 435, 6662, 4357, 970, 6517, 2536, 5714, 2538, 2712, 2902, 6158, 6664, 6273, 1300, 1409, 5298, 5820, 3888, 1131, 6161, 1618, 5154, 6522, 1860, 1861, 1862, 2086, 2087, 6523, 5159, 5723, 6667, 3096, 3097, 4202, 3273, 342, 1864, 5156, 6275, 5588, 6065, 2907, 5906, 3098, 3099, 5726, 6276, 5518, 5729, 5731, 5907]. **Point** [5909, 6277, 6403, 4364, 3893, 5519, 1303, 1626, 1221, 2391, 6167, 6281, 6673, 255, 6283, 1627, 5912, 6168, 344, 1223, 1307, 1416, 1986, 2913, 3760, 3894, 3895, 4211, 4365, 4554, 4853, 4854, 5015, 5405, 4368, 3762, 742, 745, 7006, 5302, 1870, 5735, 2545, 6532, 1750, 890, 1041, 5304, 3287, 5522, 4372, 827, 4219, 3455, 2407, 2921, 5307, 5308, 5825, 4377, 3769, 750, 751, 893, 1045, 752, 5827, 5915, 3291, 3903, 6539, 6540, 6891, 6892, 6289, 6074, 6171, 6292, 6294, 5172, 6413, 1636, 6077, 5030, 2103, 2740, 2742, 2929, 5831, 6173, 4568, 4868, 5033, 6174, 6297, 6542, 4389, 1528, 440]. **Point** [5316, 5317, 7015, 7017, 6178, 1141, 2105, 5176, 5983, 6419, 831, 904, 1430, 570, 5744, 6179, 3295, 2934, 2935, 2245, 2424, 6305, 6548, 2746, 4882, 2555, 6550, 639, 686, 2557, 5926, 6422, 1640, 2753, 7023, 1642, 5837, 6795, 4579, 525, 576, 3784, 402, 2562, 1148, 4399, 1998, 6312, 3471, 3136, 5607, 4400, 6423, 7026, 7084, 982, 5533, 5326, 3787, 449, 5988, 5989, 6315, 6316, 6317, 6559, 6560, 362, 4402, 4587, 2432, 5535, 1531, 1763, 6184, 641, 1895, 2116, 2256, 2436, 2437, 3141, 5051, 5611, 6186, 6425, 1151, 2765, 7036, 4407, 2443, 2444, 6427, 6563, 6691, 5929, 915, 5058]. **Point** [5930, 5995, 3791, 5185, 5334, 7035, 3481, 2774, 4078, 3651, 3653, 3655, 3794, 3795, 5061, 2569, 2962, 5932, 4414, 2777, 2778, 5420, 7038, 2003, 644, 1058, 1324, 2573, 2262, 4416, 4593, 4253, 6192, 6697, 1156, 1234, 1326, 5934, 5996, 2127, 7042, 701, 4256, 4422, 5997, 2785, 2786, 3152, 3662, 6568, 5540, 2789, 2973, 1772, 2582, 3155, 4899, 5616, 5427, 5428, 6432, 6433, 2272, 991, 2273, 1238, 3669, 921, 922, 6195, 2274, 993, 3158, 2275, 4605, 5617, 2276, 2797, 5068, 5436, 5437, 5619, 5939, 4262, 6700, 6438, 1540, 6329, 1679, 453, 1680, 6330, 5767, 3932, 5070, 1543, 4094, 2594, 1454, 1775, 4910]. **Point** [5072, 5344, 2282, 4102, 4438, 4752, 5073, 5768, 7052, 4612, 5075, 2983, 7057, 1776, 5629, 5854, 2595, 3680, 2461, 269, 212, 2984, 2017, 5771, 1686, 2805, 2990, 3178, 3179, 3180, 3342, 3685, 3686, 2287, 5944, 6205, 6930, 7062, 3343, 6106, 6107, 6580, 2020, 2021, 1689, 2995, 5945, 2601, 4915, 843, 1338, 1458, 1459, 1785, 5546, 3941, 3942, 5086, 1340, 4113, 5857, 3944, 1786, 5548, 2470, 2607, 2608, 3002, 5089, 5090, 1465, 5549, 6707, 1789, 5213, 5357, 6592, 3517, 4922, 6109, 6593, 4121, 592, 3347, 4455, 6336, 6005, 7066, 6443, 1072, 5358, 2027, 848, 5550, 2822, 3518, 2824, 6709]. **Point**

[3350, 6337, 1349, 490, 5093, 5859, 6598, 3830, 3193, 6211, 6445, 2299, 3948, 6711, 215, 6345, 1469, 1701, 2617, 5099, 5222, 5366, 5367, 5558, 5559, 5640, 5643, 6447, 1556, 1354, 2033, 5780, 7069, 3011, 3012, 5949, 216, 3201, 2302, 6213, 4281, 6114, 1797, 4468, 5225, 2625, 799, 3019, 1706, 3529, 5373, 5783, 4136, 948, 1941, 6828, 6829, 5952, 6608, 5106, 5562, 5647, 5107, 5374, 5231, 6610, 5692, 5886, 6034, 6758, 4624, 6340, 4279, 2172, 4489, 3375, 5375, 662, 2851, 2630, 1943, 1944, 6449, 6951, 3957, 1564, 4484, 5650, 6215, 3023, 2170, 2171, 3705, 3842, 5455, 416, 5456, 3535, 6015]. **point** [6118, 6016, 720, 296, 1485, 2492, 2634, 3029, 3214, 3215, 3380, 3381, 3382, 3383, 4488, 6351, 6458, 6459, 6956, 2493, 1085, 1010, 1947, 2040, 5655, 1800, 2312, 1801, 1802, 1362, 2314, 1569, 1570, 2041, 2315, 4782, 6122, 4145, 4297, 1487, 2496, 2861, 3037, 5568, 5873, 2043, 1262, 1368, 1807, 2180, 2497, 2181, 1809, 5874, 4300, 2045, 2319, 6961, 2643, 3221, 3039, 2320, 4303, 5241, 5242, 1091, 2182, 1370, 2323, 5799, 4786, 2498, 1190, 5122, 3852, 2185, 2324, 6232, 6467, 2325, 2186, 2326, 2646, 2647, 3045, 1813, 4308, 4503, 4653, 4789, 4790, 4791, 5123, 5245, 5959]. **point** [6234, 6966, 3717, 6967, 1578, 1579, 1716, 299, 2187, 1718, 666, 5248, 5570, 4311, 3853, 1015, 4794, 5251, 5383, 5571, 6969, 6970, 7076, 2188, 1016, 1193, 6474, 4796, 4970, 6360, 5803, 6633, 3226, 4971, 3556, 2503, 1815, 4797, 2190, 2656, 6362, 6363, 1954, 6478, 1377, 6479, 3401, 6241, 1378, 4801, 4972, 2661, 3228, 379, 1585, 2662, 6364, 3856, 4975, 1818, 2056, 2665, 3723, 3858, 5880, 1380, 1722, 2200, 2666, 2667, 2668, 5961, 6028, 2335, 3050, 4509, 5478, 3979, 3051, 3980, 5962, 4803, 4804, 3983, 1501, 1589, 1824, 2202, 5480, 5686, 6135, 4162, 2674, 1104, 1961, 3989, 4671]. **point** [4516, 421, 2062, 5483, 3412, 5688, 3726, 2342, 2870, 2871, 2872, 3866, 3995, 3237, 6251, 2679, 6252, 5392, 5393, 959, 1276, 2681, 6374, 5965, 5693, 3059, 2878, 3241, 3416, 4522, 4676, 4816, 6139, 6037, 3998, 3061, 249, 4820, 5136, 5266, 5267, 4336, 4679, 961, 4525, 5579, 6648, 5138, 2516, 5271, 2517, 4985, 2348, 4169, 2882, 5272, 2205, 502, 1733, 1734, 1832, 2884, 4001, 1202, 1394, 5274, 5139, 5491, 734, 1116, 4991, 4174, 4175, 6880, 4686, 4687, 5582, 4688, 1512, 1968, 2360, 1736, 4689, 1969, 735, 819, 508, 821, 3737, 6652, 6990, 1204, 5281, 1029, 2073, 6257, 2890, 2364, 4834]. **point** [2524, 6653, 4693, 5813, 4694, 282, 3076, 3252, 4696, 4837, 5814, 3077, 2526, 621, 879, 1030, 1208, 1283, 1739, 3428, 2368, 2892, 3078, 1031, 2702, 1843, 5501, 967, 1844, 2530, 1845, 5702, 2370, 4840, 4841, 1846, 5399, 5974, 6051, 6504, 1287, 1610, 2371, 252, 178, 307, 2706, 3882, 2375, 1850, 4351, 4844, 3883, 2532, 4022, 6660, 6661, 3080, 4023, 3745, 5003, 3593, 5819, 6997, 4024, 4540, 4700, 6508, 3750, 5149, 2894, 2895, 3255, 3595, 4192, 6391, 1036, 3083, 3434, 3596, 1291, 1407, 5008, 1213, 1974, 3598, 2219, 3435, 1408, 1296, 3260, 3090, 4030, 2220, 3440, 5513, 4548]. **point** [2900, 2535, 3091, 1298, 2711, 5294, 5295, 1744, 6663, 2903, 6396, 6521, 6665, 5716, 3265, 3266, 2084, 5717, 516, 2717, 826, 1215, 2383, 5719, 681, 2385, 3891, 1218, 1863, 7002, 1746, 3275, 3608, 4207, 5157, 5158, 5160, 5514, 2223, 2224, 4034, 4551, 5300, 3607, 1133, 4206, 1219, 1866, 2386, 4707, 5905, 2906, 4553, 5727, 5728, 1624, 3278, 5976, 6165, 6278, 6279, 6402, 2389, 201, 2088, 4039, 3611, 5977, 6406, 2227, 2911, 3102, 3279, 5978, 2229, 2395, 2396, 2230, 3103, 1985, 626, 2092, 2093, 3449, 3614, 3615,

4210, 4212, 5733, 4709, 2915, 3281, 3451, 3617, 3282, 6068, 628, 473, 744, 2399]. **point** [2400, 3283, 3284, 2401, 2402, 746, 747, 1224, 258, 5020, 2546, 2235, 2097, 1632, 311, 520, 4860, 4861, 2734, 1225, 1226, 2406, 2408, 2409, 2920, 1751, 1874, 1527, 1752, 5596, 6786, 3623, 3901, 4378, 3115, 3290, 1987, 4864, 5598, 4560, 895, 2924, 3456, 5309, 829, 897, 973, 1993, 6070, 4222, 5916, 6072, 4865, 2551, 3292, 899, 975, 2926, 7012, 2241, 2242, 6288, 5918, 6411, 4565, 4866, 6291, 6679, 3904, 3905, 5829, 5173, 7081, 6176, 349, 755, 2417, 2741, 2928, 3117, 4567, 5832, 6078, 5981, 5922, 6791, 4869, 3777, 4392, 4573, 351, 6418, 4575, 3908, 4870, 524, 571, 683, 5602, 1757, 5320, 3630]. **point** [5603, 5924, 1638, 5322, 5323, 4230, 5985, 4872, 6549, 2247, 1889, 1050, 1995, 1313, 1759, 2941, 3637, 573, 640, 757, 758, 401, 3639, 688, 689, 979, 574, 5986, 2249, 4874, 1996, 1997, 980, 909, 3126, 6181, 3127, 1434, 2561, 4580, 4724, 5751, 6085, 3129, 2251, 2114, 6901, 6311, 2756, 5045, 2252, 5325, 3135, 6686, 7025, 1646, 6687, 3138, 1647, 1648, 695, 2563, 2253, 5752, 5840, 3473, 5327, 4881, 5047, 5329, 5330, 5331, 5415, 5534, 6903, 2564, 1999, 3914, 5050, 5417, 319, 1894, 2255, 2435, 2438, 2440, 2762, 3647, 5991, 1437, 3915, 2117, 2954, 2955, 917, 5613, 7032]. **point** [5418, 2441, 2442, 984, 4243, 3309, 4731, 2959, 2259, 3144, 6189, 3310, 3311, 3920, 4077, 2446, 3796, 4890, 6914, 2570, 3316, 580, 4891, 5335, 5846, 6191, 480, 4245, 3146, 3147, 5336, 5538, 6097, 5847, 985, 4248, 4083, 4251, 5758, 765, 986, 3799, 4084, 7041, 4737, 3323, 6099, 4894, 645, 1327, 2004, 5759, 5615, 2263, 208, 700, 989, 2264, 2968, 2265, 3801, 7043, 2266, 2267, 2579, 3325, 2007, 526, 7044, 3492, 2268, 837, 7091, 2583, 2791, 2975, 4900, 2008, 2271, 3328, 4087, 5762, 2451, 2586, 2795, 2976, 2587, 2588, 1773, 2135, 1332, 5065, 6809, 992, 528, 1240, 1241, 1333, 706]. **point** [1062, 2977, 1063, 3329, 1677, 483, 4906, 3496, 773, 5936, 6197, 5621, 5622, 5849, 6200, 5765, 3928, 3929, 4091, 1336, 4907, 4607, 1913, 3159, 107, 5766, 5625, 6439, 997, 2978, 2457, 3930, 3931, 5626, 3672, 3332, 776, 2013, 2279, 2593, 2141, 7051, 4908, 6003, 780, 709, 710, 3170, 3811, 4103, 4751, 5543, 3933, 4268, 4439, 4912, 4913, 5769, 3935, 3677, 2799, 2800, 2981, 2982, 2801, 1685, 3339, 3175, 5943, 2284, 3679, 3813, 4613, 4914, 926, 3340, 3176, 3505, 2016, 3506, 2147, 1065, 3937, 5199, 1546, 2463, 787, 4110, 4440, 6703, 3814, 2466, 1688, 1921, 2994, 4615]. **point** [1690, 2288, 1169, 2467, 2468, 4441, 4442, 4617, 5080, 5081, 5082, 5203, 5204, 5205, 5206, 5207, 5208, 5349, 5350, 5351, 5352, 5441, 5442, 5443, 5444, 5445, 2809, 2996, 1784, 1460, 2291, 292, 1461, 2024, 2025, 4759, 3689, 4116, 375, 323, 4271, 4761, 845, 2817, 2818, 3186, 3187, 6206, 5088, 1928, 3690, 4762, 4119, 147, 1464, 1787, 1930, 2294, 1934, 1788, 3003, 5212, 6334, 3004, 1696, 846, 3346, 4452, 4923, 1071, 3348, 1346, 4122, 7065, 4277, 7087, 1791, 3692, 1792, 3827, 5359, 1697, 1936, 3190, 4125, 4278, 2029, 941, 6338, 2826, 2827, 4926, 4927, 715, 794, 3693, 1075, 5551, 1793]. **point** [2615, 2476, 2478, 3695, 4458, 4459, 1350, 2031, 6444, 5220, 1351, 2829, 2160, 492, 2481, 849, 1702, 3950, 2484, 3007, 4768, 4932, 5221, 5368, 5779, 6008, 6212, 2485, 1795, 1471, 1472, 1473, 1474, 1703, 1355, 1796, 540, 541, 542, 3952, 2162, 2301, 5100, 795, 2034, 2486, 2487, 1255, 294, 1704, 2163, 3202, 3365, 1938, 1559, 2304, 2836, 2488, 1356, 2621, 2622, 4129, 5224, 1798, 1560, 4935, 5227, 5561, 5781, 5950, 947, 2624, 4131, 4282, 4936, 4937, 7071, 5782, 598, 797, 1357, 2841, 6943, 194, 2843, 2307, 6714, 2489,

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1. Table 5 (page 124):

insert `k <-- 0` after assertion, and also delete `k <-- 0` from Table 6.

2. Table 9 (page 125):
   for `-1:USER!("");`
   substitute `-1:USER!("0");`
   and delete the comment.
3. Table 10 (page 125):
   for `fill(-k, "0")`
   substitute `fill(-k-1, "0")`

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- branch and bound algorithms for global optimization,
- constraint propagation,
- solution sets of linear systems,
- hardware and software systems for interval computations, and
- fuzzy logic.

Actual applications described in the book include:

- economic input-output models,
- quality control in manufacturing design,
- a computer-assisted proof in quantum mechanics,
- medical expert systems,
- and others.

A realistic view of interval computations is taken: the articles indicate when and how overestimation and other challenges can be overcome. An introductory chapter explains the content of the papers in terminology accessible to mathematically literate graduate students. The style of

the individual, refereed contributions has been made uniform and understandable, and there is an extensive book-wide index. Audience: Valuable to students and researchers interested in automatic result verification. Detailed information, including contents, contributors, and an order form can be found:

- on Kluwer homepage `http://www.wkap.nl`, or
- on the Interval Computations homepage `http://cs.utep.edu/interval-comp/main.html`, in the "Books" section.

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Industry immediately started to investigate the failure." From the report: "The internal SRI software exception was caused during execution of a data conversion from 64-bit floating point to 16-bit signed integer value. The floating point number which was converted had a value greater than what could be represented by a 16-bit signed integer. This resulted in an Operand Error. The data conversion instructions (in Ada code) were not protected from causing an Operand Error, although other conversions of comparable variables in the same place in the code were protected.".

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The main aim is to produce a usably efficient implementation, which can be easily interfaced with existing C++ code. This contrasts with previous implementations in functional languages (Haskell, Miranda etc.), which, although theoretically important, seem to be rather too slow for real use.

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- branch and bound algorithms for global optimization,
- constraint propagation,
- solution sets of linear systems,
- hardware and software systems for interval computations, and
- fuzzy logic.

Actual applications described in the book include:

- economic input-output models,
- quality control in manufacturing design,
- a computer-assisted proof in quantum mechanics,
- medical expert systems,
- and others.

A realistic view of interval computations is taken: the articles indicate when and how overestimation and other challenges can be overcome. An introductory chapter explains the content of the papers in terminology accessible to mathematically literate graduate students. The style of

the individual, refereed contributions has been made uniform and understandable, and there is an extensive book-wide index. Audience: Valuable to students and researchers interested in automatic result verification. Detailed information, including contents, contributors, and an order form can be found:

- on Kluwer homepage `http://www.wkap.nl`, or
- on the Interval Computations homepage `http://cs.utep.edu/interval-comp/main.html`, in the "Books" section.

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