

```
In [1]: import numpy as np
```

## 1. Create an array with zeros and ones

```
In [2]: print(np.zeros(10), np.ones(10))
```

```
[0. 0. 0. 0. 0. 0. 0. 0. 0. 0.] [1. 1. 1. 1. 1. 1. 1. 1. 1. 1.]
```

## 2. Create an array and print the output

```
In [3]: a=np.array([[1,2,32,4,5,7],[1,3,4,5,6,8]])
print(a)
```

```
[[ 1  2 32  4  5  7]
 [ 1  3  4  5  6  8]]
```

## 3. Create an array whose initial content is random and print the output

```
In [4]: print(np.empty(50))
```

```
[8.10696872e-312 8.10706680e-312 2.23795895e-312 0.00000000e+000
 1.69484279e-319 2.23795894e-312 0.00000000e+000 8.10704717e-312
 0.00000000e+000 0.00000000e+000 0.00000000e+000 8.10706128e-312
 2.47032823e-323 6.95166667e-310 2.02369289e-320 2.47032823e-323
 6.95166667e-310 9.88131292e-324 0.00000000e+000 0.00000000e+000
 1.29516345e-318 0.00000000e+000 nan 0.00000000e+000
 3.56043053e-307 1.60219306e-306 7.56571288e-307 1.89146896e-307
 1.37961302e-306 1.05699242e-307 8.01097889e-307 1.78020169e-306
 7.56601165e-307 1.02359984e-306 1.33510679e-306 2.22522597e-306
 1.33511018e-306 6.23057689e-307 1.86921279e-306 8.90098127e-307
 1.78020848e-306 1.60219035e-306 1.42418172e-306 2.04712906e-306
 7.56589622e-307 1.11258277e-307 8.90111708e-307 0.00000000e+000
 0.00000000e+000 0.00000000e+000]
```

## 4. Create an array with range with even intervals

```
In [5]: print(np.arange(0,1000,2))
```

```
[ 0  2  4  6  8 10 12 14 16 18 20 22 24 26 28 30 32 34
 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70
 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106
 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142
 144 146 148 150 152 154 156 158 160 162 164 166 168 170 172 174 176 178
 180 182 184 186 188 190 192 194 196 198 200 202 204 206 208 210 212 214
 216 218 220 222 224 226 228 230 232 234 236 238 240 242 244 246 248 250
 252 254 256 258 260 262 264 266 268 270 272 274 276 278 280 282 284 286
 288 290 292 294 296 298 300 302 304 306 308 310 312 314 316 318 320 322
 324 326 328 330 332 334 336 338 340 342 344 346 348 350 352 354 356 358
 360 362 364 366 368 370 372 374 376 378 380 382 384 386 388 390 392 394
 396 398 400 402 404 406 408 410 412 414 416 418 420 422 424 426 428 430
 432 434 436 438 440 442 444 446 448 450 452 454 456 458 460 462 464 466]
```

```

468 470 472 474 476 478 480 482 484 486 488 490 492 494 496 498 500 502
504 506 508 510 512 514 516 518 520 522 524 526 528 530 532 534 536 538
540 542 544 546 548 550 552 554 556 558 560 562 564 566 568 570 572 574
576 578 580 582 584 586 588 590 592 594 596 598 600 602 604 606 608 610
612 614 616 618 620 622 624 626 628 630 632 634 636 638 640 642 644 646
648 650 652 654 656 658 660 662 664 666 668 670 672 674 676 678 680 682
684 686 688 690 692 694 696 698 700 702 704 706 708 710 712 714 716 718
720 722 724 726 728 730 732 734 736 738 740 742 744 746 748 750 752 754
756 758 760 762 764 766 768 770 772 774 776 778 780 782 784 786 788 790
792 794 796 798 800 802 804 806 808 810 812 814 816 818 820 822 824 826
828 830 832 834 836 838 840 842 844 846 848 850 852 854 856 858 860 862
864 866 868 870 872 874 876 878 880 882 884 886 888 890 892 894 896 898
900 902 904 906 908 910 912 914 916 918 920 922 924 926 928 930 932 934
936 938 940 942 944 946 948 950 952 954 956 958 960 962 964 966 968 970
972 974 976 978 980 982 984 986 988 990 992 994 996 998]

```

## 5. Create an array with values that are spaced linearly in a specified interval

In [6]:

```
print(np.linspace(0,5000,num=1000))
```

```

[  0.          5.00500501  10.01001001  15.01501502  20.02002002
 25.02502503  30.03003003  35.03503504  40.04004004  45.04504505
 50.05005005  55.05505506  60.06006006  65.06506507  70.07007007
 75.07507508  80.08008008  85.08508509  90.09009009  95.0950951
100.1001001  105.10510511 110.11011011 115.11511512 120.12012012
125.12512513 130.13013013 135.13513514 140.14014014 145.14514515
150.15015015 155.15515516 160.16016016 165.16516517 170.17017017
175.17517518 180.18018018 185.18518519 190.19019019 195.1951952
200.2002002  205.20520521 210.21021021 215.21521522 220.22022022
225.22522523 230.23023023 235.23523524 240.24024024 245.24524525
250.25025025 255.25525526 260.26026026 265.26526527 270.27027027
275.27527528 280.28028028 285.28528529 290.29029029 295.2952953
300.3003003  305.30530531 310.31031031 315.31531532 320.32032032
325.32532533 330.33033033 335.33533534 340.34034034 345.34534535
350.35035035 355.35535536 360.36036036 365.36536537 370.37037037
375.37537538 380.38038038 385.38538539 390.39039039 395.3953954
400.4004004  405.40540541 410.41041041 415.41541542 420.42042042
425.42542543 430.43043043 435.43543544 440.44044044 445.44544545
450.45045045 455.45545546 460.46046046 465.46546547 470.47047047
475.47547548 480.48048048 485.48548549 490.49049049 495.4954955
500.5005005  505.50550551 510.51051051 515.51551552 520.52052052
525.52552553 530.53053053 535.53553554 540.54054054 545.54554555
550.55055055 555.55555556 560.56056056 565.56556557 570.57057057
575.57557558 580.58058058 585.58558559 590.59059059 595.5955956
600.6006006  605.60560561 610.61061061 615.61561562 620.62062062
625.62562563 630.63063063 635.63563564 640.64064064 645.64564565
650.65065065 655.65565566 660.66066066 665.66566567 670.67067067
675.67567568 680.68068068 685.68568569 690.69069069 695.6956957
700.7007007  705.70570571 710.71071071 715.71571572 720.72072072
725.72572573 730.73073073 735.73573574 740.74074074 745.74574575
750.75075075 755.75575576 760.76076076 765.76576577 770.77077077
775.77577578 780.78078078 785.78578579 790.79079079 795.7957958
800.8008008  805.80580581 810.81081081 815.81581582 820.82082082
825.82582583 830.83083083 835.83583584 840.84084084 845.84584585
850.85085085 855.85585586 860.86086086 865.86586587 870.87087087
875.87587588 880.88088088 885.88588589 890.89089089 895.8958959
900.9009009  905.90590591 910.91091091 915.91591592 920.92092092
925.92592593 930.93093093 935.93593594 940.94094094 945.94594595
950.95095095 955.95595596 960.96096096 965.96596597 970.97097097
975.97597598 980.98098098 985.98598599 990.99099099 995.995996
1001.001001  1006.00600601 1011.01101101 1016.01601602 1021.02102102
1026.02602603 1031.03103103 1036.03603604 1041.04104104 1046.04604605
1051.05105105 1056.05605606 1061.06106106 1066.06606607 1071.07107107
1076.07607608 1081.08108108 1086.08608609 1091.09109109 1096.0960961

```

1101.1011011	1106.10610611	1111.11111111	1116.11611612	1121.12112112
1126.12612613	1131.13113113	1136.13613614	1141.14114114	1146.14614615
1151.15115115	1156.15615616	1161.16116116	1166.16616617	1171.17117117
1176.17617618	1181.18118118	1186.18618619	1191.19119119	1196.1961962
1201.2012012	1206.20620621	1211.21121121	1216.21621622	1221.22122122
1226.22622623	1231.23123123	1236.23623624	1241.24124124	1246.24624625
1251.25125125	1256.25625626	1261.26126126	1266.26626627	1271.27127127
1276.27627628	1281.28128128	1286.28628629	1291.29129129	1296.2962963
1301.3013013	1306.30630631	1311.31131131	1316.31631632	1321.32132132
1326.32632633	1331.33133133	1336.33633634	1341.34134134	1346.34634635
1351.35135135	1356.35635636	1361.36136136	1366.36636637	1371.37137137
1376.37637638	1381.38138138	1386.38638639	1391.39139139	1396.3963964
1401.4014014	1406.40640641	1411.41141141	1416.41641642	1421.42142142
1426.42642643	1431.43143143	1436.43643644	1441.44144144	1446.44644645
1451.45145145	1456.45645646	1461.46146146	1466.46646647	1471.47147147
1476.47647648	1481.48148148	1486.48648649	1491.49149149	1496.4964965
1501.5015015	1506.50650651	1511.51151151	1516.51651652	1521.52152152
1526.52652653	1531.53153153	1536.53653654	1541.54154154	1546.54654655
1551.55155155	1556.55655656	1561.56156156	1566.56656657	1571.57157157
1576.57657658	1581.58158158	1586.58658659	1591.59159159	1596.5965966
1601.6016016	1606.60660661	1611.61161161	1616.61661662	1621.62162162
1626.62662663	1631.63163163	1636.63663664	1641.64164164	1646.64664665
1651.65165165	1656.65665666	1661.66166166	1666.66666667	1671.67167167
1676.67667668	1681.68168168	1686.68668669	1691.69169169	1696.6966967
1701.7017017	1706.70670671	1711.71171171	1716.71671672	1721.72172172
1726.72672673	1731.73173173	1736.73673674	1741.74174174	1746.74674675
1751.75175175	1756.75675676	1761.76176176	1766.76676677	1771.77177177
1776.77677678	1781.78178178	1786.78678679	1791.79179179	1796.7967968
1801.8018018	1806.80680681	1811.81181181	1816.81681682	1821.82182182
1826.82682683	1831.83183183	1836.83683684	1841.84184184	1846.84684685
1851.85185185	1856.85685686	1861.86186186	1866.86686687	1871.87187187
1876.87687688	1881.88188188	1886.88688689	1891.89189189	1896.8968969
1901.9019019	1906.90690691	1911.91191191	1916.91691692	1921.92192192
1926.92692693	1931.93193193	1936.93693694	1941.94194194	1946.94694695
1951.95195195	1956.95695696	1961.96196196	1966.96696697	1971.97197197
1976.97697698	1981.98198198	1986.98698699	1991.99199199	1996.996997
2002.002002	2007.00700701	2012.01201201	2017.01701702	2022.02202202
2027.02702703	2032.03203203	2037.03703704	2042.04204204	2047.04704705
2052.05205205	2057.05705706	2062.06206206	2067.06706707	2072.07207207
2077.07707708	2082.08208208	2087.08708709	2092.09209209	2097.0970971
2102.1021021	2107.10710711	2112.11211211	2117.11711712	2122.12212212
2127.12712713	2132.13213213	2137.13713714	2142.14214214	2147.14714715
2152.15215215	2157.15715716	2162.16216216	2167.16716717	2172.17217217
2177.17717718	2182.18218218	2187.18718719	2192.19219219	2197.1971972
2202.2022022	2207.20720721	2212.21221221	2217.21721722	2222.22222222
2227.22722723	2232.23223223	2237.23723724	2242.24224224	2247.24724725
2252.25225225	2257.25725726	2262.26226226	2267.26726727	2272.27227227
2277.27727728	2282.28228228	2287.28728729	2292.29229229	2297.2972973
2302.3023023	2307.30730731	2312.31231231	2317.31731732	2322.32232232
2327.32732733	2332.33233233	2337.33733734	2342.34234234	2347.34734735
2352.35235235	2357.35735736	2362.36236236	2367.36736737	2372.37237237
2377.37737738	2382.38238238	2387.38738739	2392.39239239	2397.3973974
2402.4024024	2407.40740741	2412.41241241	2417.41741742	2422.42242242
2427.42742743	2432.43243243	2437.43743744	2442.44244244	2447.44744745
2452.45245245	2457.45745746	2462.46246246	2467.46746747	2472.47247247
2477.47747748	2482.48248248	2487.48748749	2492.49249249	2497.4974975
2502.5025025	2507.50750751	2512.51251251	2517.51751752	2522.52252252
2527.52752753	2532.53253253	2537.53753754	2542.54254254	2547.54754755
2552.55255255	2557.55755756	2562.56256256	2567.56756757	2572.57257257
2577.57757758	2582.58258258	2587.58758759	2592.59259259	2597.5975976
2602.6026026	2607.60760761	2612.61261261	2617.61761762	2622.62262262
2627.62762763	2632.63263263	2637.63763764	2642.64264264	2647.64764765
2652.65265265	2657.65765766	2662.66266266	2667.66766767	2672.67267267
2677.67767768	2682.68268268	2687.68768769	2692.69269269	2697.6976977
2702.7027027	2707.70770771	2712.71271271	2717.71771772	2722.72272272
2727.72772773	2732.73273273	2737.73773774	2742.74274274	2747.74774775
2752.75275275	2757.75775776	2762.76276276	2767.76776777	2772.77277277
2777.77777778	2782.78278278	2787.78778779	2792.79279279	2797.7977978
2802.8028028	2807.80780781	2812.81281281	2817.81781782	2822.82282282

2827.82782783	2832.83283283	2837.83783784	2842.84284284	2847.84784785
2852.85285285	2857.85785786	2862.86286286	2867.86786787	2872.87287287
2877.87787788	2882.88288288	2887.88788789	2892.89289289	2897.8978979
2902.9029029	2907.90790791	2912.91291291	2917.91791792	2922.92292292
2927.92792793	2932.93293293	2937.93793794	2942.94294294	2947.94794795
2952.95295295	2957.95795796	2962.96296296	2967.96796797	2972.97297297
2977.97797798	2982.98298298	2987.98798799	2992.99299299	2997.997998
3003.003003	3008.00800801	3013.01301301	3018.01801802	3023.02302302
3028.02802803	3033.03303303	3038.03803804	3043.04304304	3048.04804805
3053.05305305	3058.05805806	3063.06306306	3068.06806807	3073.07307307
3078.07807808	3083.08308308	3088.08808809	3093.09309309	3098.0980981
3103.1031031	3108.10810811	3113.11311311	3118.11811812	3123.12312312
3128.12812813	3133.13313313	3138.13813814	3143.14314314	3148.14814815
3153.15315315	3158.15815816	3163.16316316	3168.16816817	3173.17317317
3178.17817818	3183.18318318	3188.18818819	3193.19319319	3198.1981982
3203.2032032	3208.20820821	3213.21321321	3218.21821822	3223.22322322
3228.22822823	3233.23323323	3238.23823824	3243.24324324	3248.24824825
3253.25325325	3258.25825826	3263.26326326	3268.26826827	3273.27327327
3278.27827828	3283.28328328	3288.28828829	3293.29329329	3298.2982983
3303.3033033	3308.30830831	3313.31331331	3318.31831832	3323.32332332
3328.32832833	3333.33333333	3338.33833834	3343.34334334	3348.34834835
3353.35335335	3358.35835836	3363.36336336	3368.36836837	3373.37337337
3378.37837838	3383.38338338	3388.38838839	3393.39339339	3398.3983984
3403.4034034	3408.40840841	3413.41341341	3418.41841842	3423.42342342
3428.42842843	3433.43343343	3438.43843844	3443.44344344	3448.44844845
3453.45345345	3458.45845846	3463.46346346	3468.46846847	3473.47347347
3478.47847848	3483.48348348	3488.48848849	3493.49349349	3498.4984985
3503.5035035	3508.50850851	3513.51351351	3518.51851852	3523.52352352
3528.52852853	3533.53353353	3538.53853854	3543.54354354	3548.54854855
3553.55355355	3558.55855856	3563.56356356	3568.56856857	3573.57357357
3578.57857858	3583.58358358	3588.58858859	3593.59359359	3598.5985986
3603.6036036	3608.60860861	3613.61361361	3618.61861862	3623.62362362
3628.62862863	3633.63363363	3638.63863864	3643.64364364	3648.64864865
3653.65365365	3658.65865866	3663.66366366	3668.66866867	3673.67367367
3678.67867868	3683.68368368	3688.68868869	3693.69369369	3698.6986987
3703.7037037	3708.70870871	3713.71371371	3718.71871872	3723.72372372
3728.72872873	3733.73373373	3738.73873874	3743.74374374	3748.74874875
3753.75375375	3758.75875876	3763.76376376	3768.76876877	3773.77377377
3778.77877878	3783.78378378	3788.78878879	3793.79379379	3798.7987988
3803.8038038	3808.80880881	3813.81381381	3818.81881882	3823.82382382
3828.82882883	3833.83383383	3838.83883884	3843.84384384	3848.84884885
3853.85385385	3858.85885886	3863.86386386	3868.86886887	3873.87387387
3878.87887888	3883.88388388	3888.88888889	3893.89389389	3898.8988989
3903.9039039	3908.90890891	3913.91391391	3918.91891892	3923.92392392
3928.92892893	3933.93393393	3938.93893894	3943.94394394	3948.94894895
3953.95395395	3958.95895896	3963.96396396	3968.96896897	3973.97397397
3978.97897898	3983.98398398	3988.98898899	3993.99399399	3998.998999
4004.004004	4009.00900901	4014.01401401	4019.01901902	4024.02402402
4029.02902903	4034.03403403	4039.03903904	4044.04404404	4049.04904905
4054.05405405	4059.05905906	4064.06406406	4069.06906907	4074.07407407
4079.07907908	4084.08408408	4089.08908909	4094.09409409	4099.0990991
4104.1041041	4109.10910911	4114.11411411	4119.11911912	4124.12412412
4129.12912913	4134.13413413	4139.13913914	4144.14414414	4149.14914915
4154.15415415	4159.15915916	4164.16416416	4169.16916917	4174.17417417
4179.17917918	4184.18418418	4189.18918919	4194.19419419	4199.1991992
4204.2042042	4209.20920921	4214.21421421	4219.21921922	4224.22422422
4229.22922923	4234.23423423	4239.23923924	4244.24424424	4249.24924925
4254.25425425	4259.25925926	4264.26426426	4269.26926927	4274.27427427
4279.27927928	4284.28428428	4289.28928929	4294.29429429	4299.2992993
4304.3043043	4309.30930931	4314.31431431	4319.31931932	4324.32432432
4329.32932933	4334.33433433	4339.33933934	4344.34434434	4349.34934935
4354.35435435	4359.35935936	4364.36436436	4369.36936937	4374.37437437
4379.37937938	4384.38438438	4389.38938939	4394.39439439	4399.3993994
4404.4044044	4409.40940941	4414.41441441	4419.41941942	4424.42442442
4429.42942943	4434.43443443	4439.43943944	4444.44444444	4449.44944945
4454.45445445	4459.45945946	4464.46446446	4469.46946947	4474.47447447
4479.47947948	4484.48448448	4489.48948949	4494.49449449	4499.4994995
4504.5045045	4509.50950951	4514.51451451	4519.51951952	4524.52452452
4529.52952953	4534.53453453	4539.53953954	4544.54454454	4549.54954955

```

4554.55455455 4559.55955956 4564.56456456 4569.56956957 4574.57457457
4579.57957958 4584.58458458 4589.58958959 4594.59459459 4599.5995996
4604.6046046 4609.60960961 4614.61461461 4619.61961962 4624.62462462
4629.62962963 4634.63463463 4639.63963964 4644.64464464 4649.64964965
4654.65465465 4659.65965966 4664.66466466 4669.66966967 4674.67467467
4679.67967968 4684.68468468 4689.68968969 4694.69469469 4699.6996997
4704.7047047 4709.70970971 4714.71471471 4719.71971972 4724.72472472
4729.72972973 4734.73473473 4739.73973974 4744.74474474 4749.74974975
4754.75475475 4759.75975976 4764.76476476 4769.76976977 4774.77477477
4779.77977978 4784.78478478 4789.78978979 4794.79479479 4799.7997998
4804.8048048 4809.80980981 4814.81481481 4819.81981982 4824.82482482
4829.82982983 4834.83483483 4839.83983984 4844.84484484 4849.84984985
4854.85485485 4859.85985986 4864.86486486 4869.86986987 4874.87487487
4879.87987988 4884.88488488 4889.88988989 4894.89489489 4899.8998999
4904.9049049 4909.90990991 4914.91491491 4919.91991992 4924.92492492
4929.92992993 4934.93493493 4939.93993994 4944.94494494 4949.94994995
4954.95495495 4959.95995996 4964.96496496 4969.96996997 4974.97497497
4979.97997998 4984.98498498 4989.98998999 4994.99499499 5000.

```

## 6. Access and manipulate elements in the array

```

In [7]: c=np.array([1,2,5,6,7,8,9])
        print(c)
        print(c[2])
        c[1]=12
        print(c)

```

```

[1 2 5 6 7 8 9]
5
[ 1 12  5  6  7  8  9]

```

## 7. Create a 2-dimensional array and check the shape of an array

```

In [8]: print(np.shape(b))

```

```

-----
NameError                                Traceback (most recent call last)
<ipython-input-8-ddb581196c00> in <module>
----> 1 print(np.shape(b))

NameError: name 'b' is not defined

```

## 8. Using the arange() and linspace() function to evenly space values in a specified interval

```

In [ ]: print(np.linspace(2,1000,6, dtype=np.int64))
        print(np.arange(6))

```

## 9. Create an array of random values between 0 and 1 in a given shape

```
In [ ]: print(np.random.random())
```

## 10. Repeat each element of an array by a specified number of times using repeat() and tile() functions

```
In [ ]: print(np.repeat(c,3))  
print(np.tile(c,2))
```

## 11. How do you know the shape and size of an array?

```
In [ ]: print(np.shape(a))  
print(np.size(a))
```

## 12. Create an array that indicates the total number of elements in an array

```
In [ ]: d= np.array([np.size(c)])  
print(d)
```

## 13. To find the number of dimensions of the array

```
In [ ]: print(np.ndim(a))
```

## 14. Create an array and reshape into a new array

```
In [ ]: e=np.array([9,45,56,65])  
print(e.reshape(2,2))
```

## 15. Create a null array of size 10

```
In [ ]: print(np.zeros(10))
```

## 16. Create any array with values ranging from 10 to 49 and print the numbers whose

## remainders are zero when divided by 7

```
In [ ]: f=np.arange(10,49)
        h=np.array([f])
        print(h[(h%7)==0])
```

## 17. Create an array and check any two conditions and print the output

```
In [ ]: print(a[(a>5)&(a<10)])
```

## 18. Use Arithmetic operator and print the output using array

```
In [ ]: a=np.array([1,2,3])
        b=np.array([4,5,6])
        print(a+b)
        print(b-a)
        print(a*b)
        print(b/a)
        print(b**a)
```

## 19. Use Relational operators and print the results using array

```
In [ ]: if(a[1]>=a[0]):
        print(a[1])
        if(a[0]==a[1]):
            print(a[0])
        else:
            print("No")
        if(a[2]!=a[0]):
            print("False")
        else:
            print("True")
```

## 20. Difference between python and ipython

- ipython has an interactive interpreter compared to python and it is easier to python.
- They both have different extensions
- ipython has a lot of functions to it and also helps in visualization and with unstructured data.