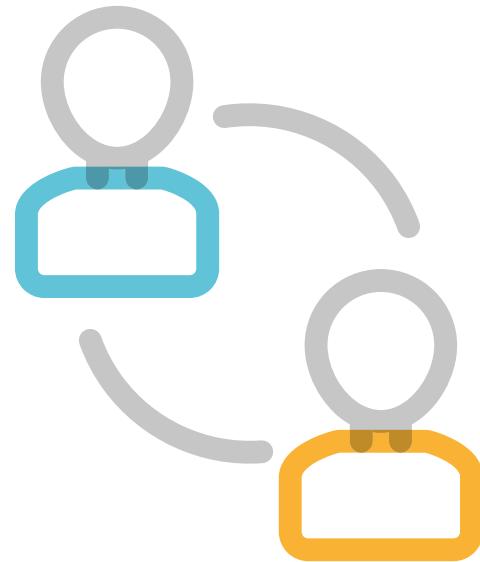


PROJECT SUKUNA



แหล่งที่มาของข้อมูล

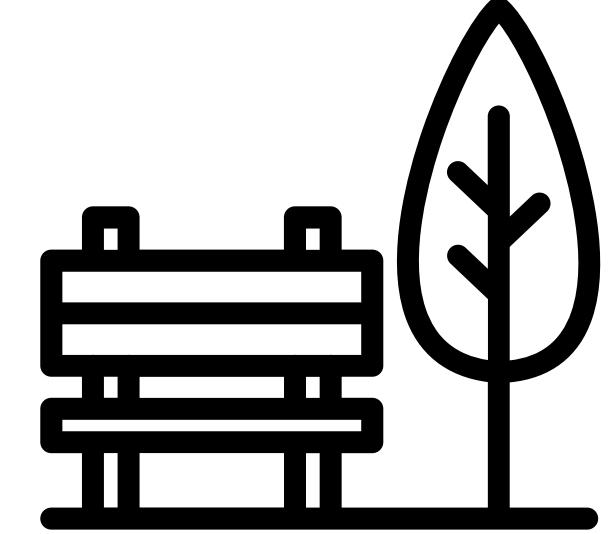


3



<http://data.bangkok.go.th/dataset/popmovement>

ข้อมูลจำนวนประชากรย้ายเข้า-ย้ายออก
ในเขตกรุงเทพมหานคร



4

<https://opendata.data.go.th/uk/dataset/district2>

ข้อมูลเบตการปักครองกรุงเทพมหานคร



วัตถุประสงค์

- กำหนดว่าปริมาณขยะที่เพิ่มขึ้น ซึ่งมีผลมาจากการจำนวนสวนสาธารณะ, จำนวนประชากร, จำนวนการย้ายเข้า และ จำนวนการย้ายออก ในเขตกรุงเทพมหานคร

ประโยชน์

- ปัจจัยที่ส่งผลการเพิ่มขึ้น-ลดลงของขยะ ได้แก่ จำนวนประชากร, การย้ายเข้า-ออก และ จำนวนสวนสาธารณะในเขตกรุงเทพมหานคร

ข้อมูลชุดที่ 1 จำนวนประชากรในกรุงเทพมหานคร



มูลชุดที่ 1 จำนวนประชากรในกรุงเทพมหานคร

| | dcode | population48 | population49 | population50 | population51 | population52 | population53 | population54 | population55 | population56 | population57 | population58 | population59 | population60 | population61 |
|----|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 0 | 1001 | 67357 | 65835 | 64356 | 62966 | 61374 | 60313 | 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 0 | 50382 |
| 1 | 1002 | 121336 | 119927 | 117867 | 116742 | 114488 | 111496 | 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 0 | 94854 |
| 2 | 1003 | 126126 | 133415 | 138667 | 143675 | 147668 | 151292 | 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 0 | 172990 |
| 3 | 1004 | 50023 | 49730 | 49124 | 48506 | 47503 | 47053 | 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 0 | 48207 |
| 4 | 1005 | 178986 | 181390 | 182335 | 183836 | 185901 | 188164 | 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 0 | 191323 |
| 5 | 1006 | 149093 | 149860 | 150139 | 150286 | 150166 | 149606 | 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 0 | 146841 |
| 6 | 1007 | 63192 | 62102 | 61040 | 60275 | 58858 | 57368 | 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 0 | 48382 |
| 7 | 1008 | 60001 | 58768 | 57461 | 56464 | 54601 | 53526 | 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 0 | 45701 |
| 8 | 1009 | 98564 | 98096 | 98496 | 97794 | 96880 | 95661 | 94482 | 93461 | 92774 | 92448 | 92206 | 91305 | 0 | 89237 |
| 9 | 1010 | 118019 | 122825 | 127727 | 131035 | 133149 | 135032 | 136236 | 137295 | 138661 | 139771 | 140335 | 141214 | 0 | 142311 |
| 10 | 1011 | 138327 | 142460 | 144800 | 147482 | 152528 | 157477 | 160850 | 163317 | 165724 | 168309 | 169517 | 171933 | 0 | 175662 |
| 11 | 1012 | 88556 | 88383 | 88061 | 87386 | 85789 | 84286 | 82481 | 81529 | 81162 | 80843 | 80381 | 79574 | 0 | 78031 |
| 12 | 1013 | 31674 | 31142 | 30646 | 30088 | 29283 | 28617 | 28001 | 27426 | 26932 | 26359 | 25863 | 24785 | 0 | 23655 |
| 13 | 1014 | 77232 | 77343 | 77202 | 76477 | 75493 | 74693 | 73533 | 73084 | 72495 | 72203 | 72283 | 72102 | 0 | 70341 |
| 14 | 1015 | 136971 | 134589 | 132034 | 129662 | 126883 | 124499 | 121539 | 119643 | 117536 | 115330 | 113622 | 111027 | 0 | 107754 |
| 15 | 1016 | 81727 | 80863 | 79637 | 78307 | 76608 | 75621 | 73864 | 72241 | 71087 | 70003 | 69543 | 67887 | 0 | 67211 |
| 16 | 1017 | 76213 | 76402 | 77033 | 76948 | 76987 | 77292 | 77720 | 78207 | 78943 | 80002 | 80549 | 81190 | 0 | 81689 |
| 17 | 1018 | 87853 | 86163 | 84821 | 82824 | 80894 | 79546 | 77471 | 76353 | 75765 | 75224 | 74836 | 73871 | 0 | 72171 |
| 18 | 1019 | 105730 | 106811 | 107812 | 107513 | 106963 | 106753 | 106786 | 106532 | 106192 | 105857 | 105585 | 105289 | 0 | 105047 |
| 19 | 1020 | 133669 | 132394 | 130540 | 129401 | 126823 | 124352 | 120032 | 117950 | 117503 | 116653 | 115479 | 112581 | 0 | 110417 |
| 20 | 1021 | 132313 | 137934 | 141698 | 145294 | 150492 | 155821 | 161642 | 165693 | 169614 | 173144 | 175829 | 179768 | 0 | 183878 |
| 21 | 1022 | 136240 | 135149 | 134407 | 133622 | 132670 | 131363 | 130493 | 129800 | 129559 | 129238 | 128581 | 127582 | 0 | 125981 |
| 22 | 1023 | 128493 | 131344 | 135554 | 139585 | 142772 | 145361 | 148298 | 150285 | 151877 | 153175 | 154018 | 155229 | 0 | 156267 |
| 23 | 1024 | 94097 | 93548 | 92929 | 92094 | 90559 | 89297 | 87841 | 86643 | 85825 | 84881 | 84256 | 83248 | 0 | 81806 |
| 24 | 1025 | 108597 | 107139 | 105347 | 103852 | 102320 | 101276 | 100319 | 99153 | 98113 | 96787 | 95829 | 93771 | 0 | 91278 |

ข้อมูลชุดที่ 2 จำนวนขยะในกรุงเทพมหานคร



ข้อมูลชุดที่ 2 จำนวนขยะในเขตกรุงเทพมหานคร

| [7] 1 garbage | dcode | garbage53 | garbageperday53 | garbage54 | garbageperday54 | garbage55 | garbageperday55 | garbage56 | garbageperday56 | garbage57 | garbageperday57 | garbage58 | garbageperday58 | garbage59 | garbageperday59 | garbage60 | garbageperday60 |
|---------------|-------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|
| 0 | 1000 | 189819.45 | 520.05 | 122869.76 | 336.63 | 133599.00 | 365.02 | 206932.0 | 566.94 | 210940.80 | 577.92 | 217247.09 | 2.74 | 199522.73 | 545.14 | 203794.98 | 558.34 |
| 1 | 1001 | 69166.29 | 189.50 | 106149.08 | 290.82 | 119485.81 | 326.46 | 71844.4 | 196.83 | 69299.50 | 189.86 | 72019.02 | 197.31 | 70243.12 | 200.00 | 72998.93 | 0.00 |
| 2 | 1002 | 62244.26 | 170.53 | 105379.61 | 288.71 | 116.37 | 317.96 | 64255.4 | 176.04 | 62915.62 | 172.37 | 63580.71 | 174.19 | 63750.08 | 173.51 | 63331.79 | 0.00 |
| 3 | 1003 | 32339.16 | 88.60 | 95059.04 | 260.44 | 97084.32 | 265.26 | 40386.7 | 110.65 | 58888.59 | 161.34 | 43111.42 | 118.11 | 43545.74 | 131.30 | 47922.93 | 0.00 |
| 4 | 1004 | 54224.38 | 148.56 | 94655.76 | 259.33 | 100306.22 | 274.06 | 60767.8 | 166.49 | 94551.77 | 259.05 | 61746.75 | 169.17 | 58286.80 | 167.05 | 60973.16 | 0.00 |
| 5 | 1005 | 85742.96 | 234.91 | 87370.03 | 239.37 | 98955.18 | 270.37 | 93232.5 | 255.43 | 119561.54 | 327.57 | 99176.79 | 271.72 | 102066.16 | 302.24 | 110318.20 | 0.00 |
| 6 | 1006 | 101745.01 | 278.75 | 87276.00 | 239.11 | 92009.14 | 251.39 | 120589.0 | 330.38 | 102164.88 | 279.90 | 113420.03 | 310.74 | 106544.60 | 338.62 | 123596.09 | 0.00 |
| 7 | 1007 | 75719.25 | 207.45 | 86006.01 | 235.63 | 94435.68 | 258.02 | 104379.0 | 285.97 | 30773.10 | 84.31 | 104085.17 | 285.16 | 30383.52 | 309.70 | 113038.70 | 0.00 |
| 8 | 1008 | 32203.77 | 88.23 | 82532.46 | 226.12 | 99912.63 | 272.99 | 32474.1 | 88.97 | 56855.12 | 155.77 | 31207.79 | 85.50 | 117706.24 | 83.97 | 30650.17 | 0.00 |
| 9 | 1009 | 48978.52 | 134.19 | 78200.31 | 214.25 | 87574.21 | 239.27 | 56903.1 | 155.90 | 43346.67 | 118.76 | 54404.30 | 149.05 | 53592.83 | 147.54 | 53853.74 | 0.00 |
| 10 | 1010 | 60341.96 | 165.32 | 75249.90 | 206.16 | 84154.63 | 229.93 | 69510.6 | 190.44 | 70706.48 | 193.72 | 69591.76 | 190.66 | 69050.94 | 190.23 | 69434.96 | 0.00 |
| 11 | 1011 | 71764.46 | 196.61 | 73467.95 | 201.28 | 80198.83 | 219.12 | 88997.5 | 243.83 | 90386.71 | 247.63 | 93967.27 | 257.44 | 95759.88 | 285.68 | 104273.38 | 0.00 |
| 12 | 1012 | 58392.59 | 159.98 | 73220.38 | 200.60 | 61517.68 | 168.08 | 64938.8 | 177.91 | 64219.38 | 175.94 | 67058.97 | 183.72 | 67770.90 | 185.41 | 67673.10 | 0.00 |
| 13 | 1013 | 21238.74 | 58.19 | 70821.47 | 194.03 | 79376.40 | 216.88 | 21322.2 | 58.42 | 20630.96 | 56.52 | 21118.32 | 57.86 | 20401.97 | 56.48 | 20614.70 | 0.00 |
| 14 | 1014 | 54181.74 | 148.44 | 70297.58 | 192.60 | 71079.63 | 194.21 | 56694.5 | 155.33 | 56102.81 | 153.71 | 59333.23 | 162.56 | 60367.09 | 170.74 | 62318.37 | 0.00 |
| 15 | 1015 | 60352.95 | 165.35 | 70160.21 | 192.22 | 75129.41 | 205.27 | 59261.5 | 162.36 | 58793.52 | 161.08 | 59135.63 | 162.02 | 57750.21 | 163.06 | 59518.05 | 0.00 |
| 16 | 1016 | 31994.30 | 87.66 | 69971.85 | 191.70 | 70252.06 | 191.95 | 31028.6 | 85.01 | 29936.32 | 82.02 | 31169.03 | 85.39 | 29004.66 | 77.25 | 28195.81 | 0.00 |
| 17 | 1017 | 53821.52 | 147.46 | 69778.86 | 191.17 | 71742.58 | 196.02 | 72966.6 | 199.91 | 73513.35 | 201.41 | 70072.99 | 191.98 | 71851.82 | 212.64 | 77612.15 | 0.00 |
| 18 | 1018 | 43931.65 | 120.36 | 68184.05 | 186.81 | 71984.22 | 196.68 | 45999.2 | 126.03 | 45362.27 | 124.28 | 49075.86 | 134.45 | 46209.77 | 125.72 | 45886.90 | 0.00 |
| 19 | 1019 | 40731.33 | 111.59 | 65332.59 | 178.99 | 68452.05 | 187.03 | 44920.4 | 123.07 | 46197.79 | 126.57 | 48622.29 | 133.21 | 48360.44 | 143.20 | 52266.78 | 0.00 |
| 20 | 1020 | 66327.09 | 181.72 | 64951.63 | 177.95 | 73143.96 | 199.85 | 66923.3 | 183.35 | 68311.84 | 187.16 | 72829.51 | 199.53 | 70786.25 | 189.32 | 69100.22 | 0.00 |
| 21 | 1021 | 90380.85 | 247.62 | 64875.50 | 177.74 | 66280.12 | 181.09 | 101407.0 | 277.83 | 100637.34 | 275.72 | 107681.16 | 295.02 | 111452.97 | 333.12 | 121589.48 | 0.00 |
| 22 | 1022 | 54928.37 | 150.49 | 62503.79 | 171.24 | 66509.47 | 181.72 | 56241.6 | 154.09 | 56299.54 | 154.25 | 60826.77 | 166.65 | 58670.93 | 159.90 | 58363.16 | 0.00 |
| 23 | 1023 | 58451.80 | 160.14 | 60880.44 | 166.80 | 62531.84 | 170.85 | 62327.9 | 170.76 | 63247.08 | 173.28 | 63411.89 | 173.73 | 61380.55 | 170.56 | 62256.21 | 0.00 |
| 24 | 1024 | 42815.74 | 117.30 | 59626.21 | 163.36 | 62931.45 | 171.94 | 42008.5 | 115.09 | 42497.82 | 116.43 | 41717.52 | 114.29 | 41835.00 | 117.97 | 43057.74 | 0.00 |

ข้อมูลชุดที่ 3 จำนวนคนย้าย-เข้าออกในกรุงเทพมหานคร



ข้อมูลชุดที่ 3 จำนวนคนย้ายเข้า-ย้ายออกในกรุงเทพมหานคร

| | dcode | movein52 | movein53 | movein54 | movein55 | movein56 | movein57 | movein58 | movein59 | movein60 | movein61 | moveout52 | moveout53 | moveout54 | moveout55 | moveout56 | moveout57 | moveout58 | moveout59 | moveout60 | moveout61 |
|----|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0 | 1045 | 8406 | 7353 | 7078 | 6911 | 6862 | 6571 | 6284 | 6355 | 6413 | 6050 | 8218 | 7572 | 7683 | 7512 | 7294 | 7472 | 7306 | 7174 | 9393 | 9935 |
| 1 | 1035 | 9116 | 8257 | 7480 | 7685 | 7643 | 7783 | 7552 | 7238 | 6795 | 6850 | 10106 | 9990 | 10062 | 9750 | 9046 | 8600 | 8362 | 7891 | 9072 | 9141 |
| 2 | 1049 | 8941 | 8203 | 7716 | 7085 | 8209 | 8761 | 7381 | 7126 | 6860 | 6706 | 7153 | 6679 | 6426 | 5819 | 6418 | 6476 | 5567 | 6083 | 4329 | 3948 |
| 3 | 1002 | 7534 | 7352 | 7890 | 7352 | 9233 | 6847 | 6430 | 9438 | 6859 | 9040 | 10797 | 10796 | 10189 | 10379 | 12305 | 11474 | 11133 | 13091 | 4878 | 4750 |
| 4 | 1038 | 9535 | 8939 | 7979 | 7687 | 7635 | 7303 | 6712 | 6429 | 6105 | 6036 | 8164 | 8693 | 8131 | 7691 | 7441 | 7713 | 7354 | 7467 | 5486 | 5415 |
| 5 | 1050 | 8341 | 8811 | 8034 | 7220 | 6840 | 6857 | 6022 | 5615 | 5815 | 5651 | 7301 | 7483 | 7409 | 6492 | 6655 | 6886 | 6188 | 5789 | 8086 | 7984 |
| 6 | 1022 | 9164 | 7597 | 8356 | 7142 | 6795 | 7173 | 6209 | 6107 | 5697 | 5450 | 10295 | 9449 | 9650 | 8875 | 8741 | 9246 | 8749 | 8452 | 5800 | 5686 |
| 7 | 1027 | 11546 | 9854 | 9546 | 9354 | 9382 | 8863 | 8844 | 8579 | 8122 | 7892 | 10781 | 9884 | 9850 | 9524 | 9120 | 8985 | 9379 | 8462 | 6069 | 7000 |
| 8 | 1006 | 11369 | 9980 | 9547 | 9719 | 10213 | 9317 | 9292 | 9016 | 3919 | 3396 | 11425 | 10915 | 10488 | 10134 | 9851 | 9852 | 9549 | 9826 | 3518 | 3503 |
| 9 | 1010 | 11085 | 10224 | 9786 | 9588 | 9840 | 9419 | 8969 | 8763 | 8485 | 8070 | 10491 | 10444 | 10677 | 10677 | 12090 | 11916 | 12268 | 12231 | 8724 | 8300 |
| 10 | 1030 | 11871 | 9604 | 10438 | 10470 | 9911 | 9367 | 8783 | 8817 | 8646 | 8867 | 12819 | 10987 | 11668 | 11446 | 10450 | 11026 | 10564 | 10502 | 11802 | 12206 |
| 11 | 1040 | 12286 | 11375 | 11061 | 12532 | 10631 | 10613 | 10064 | 10285 | 3184 | 3160 | 13304 | 12797 | 12475 | 13649 | 11020 | 11661 | 10185 | 10126 | 14151 | 13804 |
| 12 | 1003 | 11544 | 11400 | 11730 | 11498 | 11094 | 10765 | 10681 | 10747 | 10815 | 10546 | 7294 | 7683 | 8410 | 8223 | 7920 | 7722 | 7611 | 7536 | 3330 | 3373 |
| 13 | 1032 | 12882 | 11454 | 11773 | 11911 | 11844 | 11953 | 11576 | 12813 | 11860 | 11633 | 11810 | 11609 | 10907 | 10520 | 11698 | 11222 | 10721 | 10949 | 3893 | 3747 |
| 14 | 1023 | 13146 | 12321 | 12791 | 11300 | 10798 | 10729 | 9852 | 9588 | 8759 | 8835 | 9564 | 9528 | 9685 | 9322 | 9157 | 9296 | 8407 | 8410 | 7403 | 6931 |
| 15 | 1036 | 14839 | 14355 | 13173 | 14912 | 14027 | 13582 | 13317 | 14484 | 13697 | 14315 | 13124 | 12659 | 12534 | 13503 | 12119 | 12548 | 12382 | 12982 | 8939 | 9191 |
| 16 | 1011 | 16392 | 15118 | 14147 | 12587 | 12377 | 12478 | 11494 | 11843 | 11330 | 11594 | 10844 | 9875 | 10210 | 9835 | 9526 | 9398 | 9167 | 9343 | 7116 | 7026 |
| 17 | 1005 | 16617 | 15512 | 14312 | 14858 | 13709 | 12711 | 12317 | 14337 | 8324 | 7999 | 14262 | 13287 | 13711 | 13304 | 12965 | 12767 | 12299 | 13537 | 4914 | 4890 |
| 18 | 1046 | 15189 | 15951 | 15357 | 15446 | 14986 | 15400 | 4893 | 15742 | 14849 | 14765 | 9531 | 9664 | 9889 | 10309 | 9770 | 9888 | 9921 | 9732 | 7465 | 7542 |
| 19 | 1042 | 15748 | 17826 | 16047 | 15046 | 15316 | 14971 | 14928 | 14576 | 14231 | 15583 | 14965 | 15063 | 14400 | 14641 | 16082 | 15837 | 15594 | 15326 | 9625 | 9867 |
| 20 | 1021 | 14546 | 16245 | 16665 | 13912 | 13611 | 13274 | 12968 | 12693 | 5605 | 5293 | 9939 | 11869 | 11591 | 10680 | 10530 | 10476 | 10046 | 10256 | 6198 | 6553 |
| 21 | 1029 | 9455 | 7398 | 6816 | 5932 | 5764 | 5893 | 5686 | 5510 | 6214 | 6492 | 13010 | 11429 | 9488 | 8562 | 7148 | 7000 | 6502 | 6296 | 10115 | 10118 |
| 22 | 1019 | 6378 | 5788 | 6497 | 5522 | 5224 | 5200 | 5045 | 4855 | 5064 | 4644 | 6178 | 5401 | 5712 | 5191 | 4957 | 4903 | 4674 | 4413 | 11599 | 10576 |
| 23 | 1026 | 7985 | 7269 | 6430 | 6480 | 6812 | 6034 | 6027 | 5378 | 5454 | 5943 | 9142 | 8418 | 7806 | 7407 | 7146 | 6824 | 6587 | 6152 | 3390 | 3341 |

ข้อมูลชุดที่ 1

dcode = PK ของตาราง คือเขตภายในกรุงเทพมหานคร

population48 = จำนวนประชากรในปี 2548

population48 = จำนวนประชากรในปี 2549 เป็นต้น

ข้อมูลชุดที่ 2

dcode = PK ของตาราง คือเขตภายในกรุงเทพมหานคร

garbage53 = ปริมาณขยะของกรุงเทพในปี 2553

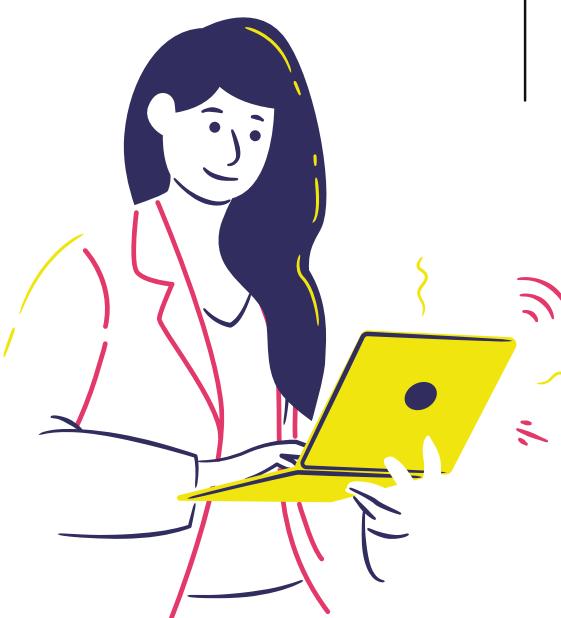
garbageperday53 = ปริมาณขยะของกรุงเทพต่อวันในปี 2553 เป็นต้น

ข้อมูลชุดที่ 3

dcode = PK ของตาราง คือเขตภายในกรุงเทพมหานคร

movein52 = จำนวนคนที่ย้ายเข้ากรุงเทพในปี 2552

moveout52 = จำนวนคนที่ย้ายออกจากกรุงเทพในปี 2552 เป็นต้น



Data Preprocessing

เรียง dcode ใหม่ ให้เป็นไปตามลำดับ

+ Code + Text

[9] 1 moveinmoveout_new = moveinmoveout.sort_values(by=['dcode'], ascending=True)
2 moveinmoveout_new

| | dcode | movein52 | movein53 | movein54 | movein55 | movein56 | movein57 | movein58 | movein59 | movein60 | movein61 | moveout52 | moveout53 | moveout54 | moveout55 | moveout56 | moveout57 | moveout58 | moveout59 | moveout60 | moveout61 |
|----|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 45 | 1001 | 3461 | 2965 | 2892 | 3189 | 2909 | 2647 | 2515 | 2815 | 2660 | 2961 | 4341 | 3573 | 3842 | 3790 | 3543 | 3590 | 3589 | 3644 | 10292 | 11239 |
| 3 | 1002 | 7534 | 7352 | 7890 | 7352 | 9233 | 6847 | 6430 | 9438 | 6859 | 9040 | 10797 | 10796 | 10189 | 10379 | 12305 | 11474 | 11133 | 13091 | 4878 | 4750 |
| 12 | 1003 | 11544 | 11400 | 11730 | 11498 | 11094 | 10765 | 10681 | 10747 | 10815 | 10546 | 7294 | 7683 | 8410 | 8223 | 7920 | 7722 | 7611 | 7536 | 3330 | 3373 |
| 47 | 1004 | 1878 | 1797 | 1626 | 1614 | 1649 | 1533 | 1499 | 1656 | 1731 | 2288 | 5586 | 5191 | 5153 | 5582 | 6496 | 6043 | 5948 | 5967 | 5290 | 5174 |
| 17 | 1005 | 16617 | 15512 | 14312 | 14858 | 13709 | 12711 | 12317 | 14337 | 8324 | 7999 | 14262 | 13287 | 13711 | 13304 | 12965 | 12767 | 12299 | 13537 | 4914 | 4890 |
| 8 | 1006 | 11369 | 9980 | 9547 | 9719 | 10213 | 9317 | 9292 | 9016 | 3919 | 3396 | 11425 | 10915 | 10488 | 10134 | 9851 | 9852 | 9549 | 9826 | 3518 | 3503 |
| 46 | 1007 | 2753 | 2880 | 2245 | 2170 | 2490 | 2173 | 2183 | 2016 | 1890 | 2074 | 6138 | 6134 | 5804 | 5393 | 10630 | 9875 | 9502 | 8863 | 8230 | 8308 |
| 48 | 1008 | 1797 | 1587 | 1441 | 1413 | 1380 | 1364 | 1249 | 1200 | 1200 | 1222 | 4773 | 4340 | 4392 | 3992 | 3859 | 3852 | 3615 | 3340 | 6400 | 6252 |
| 35 | 1009 | 5941 | 5243 | 5034 | 4873 | 4989 | 5266 | 5147 | 5586 | 4375 | 4058 | 6129 | 5925 | 5532 | 5362 | 5123 | 5000 | 4846 | 5796 | 7096 | 6820 |
| 9 | 1010 | 11085 | 10224 | 9786 | 9588 | 9840 | 9419 | 8969 | 8763 | 8485 | 8070 | 10491 | 10444 | 10677 | 10677 | 12090 | 11916 | 12268 | 12231 | 8724 | 8300 |
| 16 | 1011 | 16392 | 15118 | 14147 | 12587 | 12377 | 12478 | 11494 | 11843 | 11330 | 11594 | 10844 | 9875 | 10210 | 9835 | 9526 | 9398 | 9167 | 9343 | 7116 | 7026 |
| 38 | 1012 | 4799 | 4621 | 4300 | 4331 | 4636 | 4307 | 3981 | 4083 | 3965 | 3537 | 5479 | 5476 | 5352 | 4871 | 4523 | 4257 | 4161 | 4188 | 7757 | 7581 |
| 49 | 1013 | 1036 | 815 | 753 | 783 | 816 | 740 | 621 | 673 | 625 | 681 | 1330 | 1200 | 1097 | 1165 | 1143 | 1092 | 1083 | 1268 | 4425 | 4281 |
| 33 | 1014 | 5667 | 5338 | 5467 | 5890 | 5773 | 5822 | 5438 | 6717 | 5843 | 6447 | 7636 | 7098 | 7286 | 7772 | 7976 | 8278 | 7643 | 8460 | 10887 | 10506 |
| 34 | 1015 | 6280 | 5297 | 5315 | 5180 | 4896 | 4685 | 4348 | 4521 | 4497 | 4374 | 9975 | 8990 | 8852 | 8071 | 8105 | 8140 | 7642 | 7901 | 1080 | 997 |
| 44 | 1016 | 3852 | 3577 | 3046 | 3141 | 2974 | 2956 | 2994 | 2486 | 9749 | 10087 | 4611 | 4093 | 4083 | 4242 | 3583 | 3514 | 3212 | 3366 | 7618 | 7760 |
| 32 | 1017 | 5248 | 5178 | 5480 | 5408 | 5400 | 5799 | 5699 | 6049 | 5036 | 5326 | 6546 | 6312 | 6099 | 6544 | 6103 | 6174 | 6396 | 6943 | 5564 | 5548 |
| 40 | 1018 | 4212 | 3802 | 4154 | 3562 | 3540 | 3410 | 15956 | 2959 | 2645 | 2593 | 7528 | 6237 | 6673 | 5865 | 6202 | 6134 | 5508 | 5304 | 11036 | 11486 |
| 22 | 1019 | 6378 | 5788 | 6497 | 5522 | 5224 | 5200 | 5045 | 4855 | 5064 | 4644 | 6178 | 5401 | 5712 | 5191 | 4957 | 4903 | 4674 | 4413 | 11599 | 10576 |
| 28 | 1020 | 7350 | 6144 | 5877 | 5294 | 5906 | 5717 | 5377 | 4505 | 12507 | 13396 | 13673 | 12302 | 11912 | 11083 | 15897 | 15747 | 15834 | 14251 | 9099 | 7914 |
| 20 | 1021 | 14546 | 16245 | 16665 | 13912 | 13611 | 13274 | 12968 | 12693 | 5605 | 5293 | 9939 | 11869 | 11591 | 10680 | 10530 | 10476 | 10046 | 10256 | 6198 | 6553 |
| 6 | 1022 | 9164 | 7597 | 8356 | 7142 | 6795 | 7173 | 6209 | 6107 | 5697 | 5450 | 10295 | 9449 | 9650 | 8875 | 8741 | 9246 | 8749 | 8452 | 5800 | 5686 |
| 14 | 1023 | 13146 | 12321 | 12791 | 11300 | 10798 | 10729 | 9852 | 9588 | 8759 | 8835 | 9564 | 9528 | 9685 | 9322 | 9157 | 9296 | 8407 | 8410 | 7403 | 6931 |
| 37 | 1024 | 5794 | 4679 | 4493 | 4228 | 4253 | 4345 | 4077 | 4031 | 4024 | 4038 | 7779 | 6662 | 6451 | 6310 | 5908 | 6043 | 5601 | 5561 | 15319 | 14121 |



Data Preprocessing



หา Missing Value

```
[1] 1 population.isnull().any()
```

```
dcode      False  
population48  False  
population49  False  
population50  False  
population51  False  
population52  False  
population53  False  
population54  False  
population55  False  
population56  False  
population57  False  
population58  False  
population59  False  
population60  False  
population61  False  
dtype: bool
```

จากการตรวจสอบค่า Missing พบว่า ไม่มีค่าไหนในตารางที่มีช่องว่างเลย

```
[11] 1 garbage.isnull().any()
```

```
dcode      False  
garbage53  False  
garbageperday53  False  
garbage54  False  
garbageperday54  False  
garbage55  False  
garbageperday55  False  
garbage56  False  
garbageperday56  False  
garbage57  False  
garbageperday57  False  
garbage58  False  
garbageperday58  False  
garbage59  False  
garbageperday59  False  
garbage60  False  
garbageperday60  False  
garbage61  False  
garbageperday61  False  
dtype: bool
```

จากการตรวจสอบค่า Missing พบว่า ไม่มีค่าไหนในตารางที่มีช่องว่างเลย

```
[12] 1 moveinmoveout.isnull().any()
```

```
dcode      False  
movein52  False  
movein53  False  
movein54  False  
movein55  False  
movein56  False  
movein57  False  
movein58  False  
movein59  False  
movein60  False  
movein61  False  
moveout52  False  
moveout53  False  
moveout54  False  
moveout55  False  
moveout56  False  
moveout57  False  
moveout58  False  
moveout59  False  
moveout60  False  
moveout61  False  
dtype: bool
```

จากการตรวจสอบค่า Missing พบว่า ไม่มีค่าไหนในตารางที่มีช่องว่างเลย

Data Preprocessing



ตัด column ตั้งแต่ปี 48-52 ออก เพราะต้องการตั้งแต่ปี 53

```
[15] 1 population.drop(['population48', 'population49', 'population50', 'population51', 'population52'], axis=1, inplace=True)
```

1 population

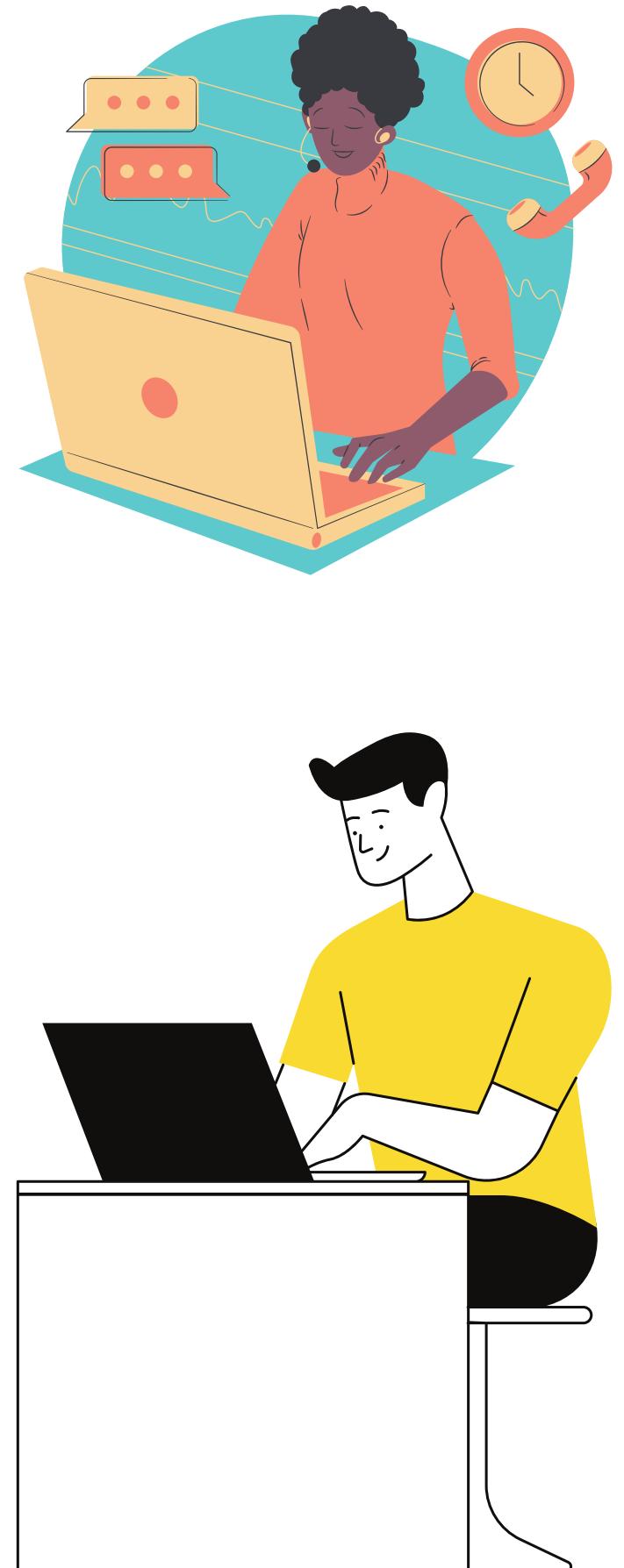
| | | | | | | | | | |
|----|------|--------|--------|--------|--------|--------|--------|--------|--------|
| 18 | 1019 | 106753 | 106786 | 106532 | 106192 | 105857 | 105585 | 105289 | 105047 |
| 19 | 1020 | 124352 | 120032 | 117950 | 117503 | 116653 | 115479 | 112581 | 110417 |
| 20 | 1021 | 155821 | 161642 | 165693 | 169614 | 173144 | 175829 | 179768 | 183878 |
| 21 | 1022 | 131363 | 130493 | 129800 | 129559 | 129238 | 128581 | 127582 | 125981 |
| 22 | 1023 | 145361 | 148298 | 150285 | 151877 | 153175 | 154018 | 155229 | 156267 |
| 23 | 1024 | 89297 | 87841 | 86643 | 85825 | 84881 | 84256 | 83248 | 81806 |
| 24 | 1025 | 101276 | 100319 | 99153 | 98113 | 96787 | 95829 | 93771 | 91278 |
| 25 | 1026 | 134480 | 131847 | 130202 | 128838 | 127260 | 126191 | 123966 | 120761 |
| 26 | 1027 | 147030 | 146197 | 145795 | 145822 | 145514 | 144951 | 144449 | 142990 |
| 27 | 1028 | 88179 | 86214 | 85048 | 83898 | 82432 | 81877 | 80497 | 78860 |
| 28 | 1029 | 138653 | 135001 | 132169 | 130511 | 128995 | 127961 | 126136 | 125299 |
| 29 | 1030 | 162838 | 161409 | 160853 | 160948 | 160366 | 159642 | 158130 | 155923 |
| 30 | 1031 | 98870 | 96422 | 94877 | 93508 | 92273 | 91574 | 90377 | 88288 |
| 31 | 1032 | 156567 | 158457 | 160816 | 163485 | 166364 | 168369 | 172761 | 178290 |
| 32 | 1033 | 112906 | 110481 | 109001 | 108066 | 107221 | 106467 | 104211 | 101543 |
| 33 | 1034 | 115966 | 115419 | 115731 | 116688 | 118371 | 119794 | 121740 | 123026 |
| 34 | 1035 | 160451 | 158646 | 157970 | 157156 | 156030 | 155106 | 153668 | 151174 |
| 35 | 1036 | 166354 | 166210 | 166635 | 167827 | 168197 | 169255 | 168896 | 169259 |
| 36 | 1037 | 76233 | 72900 | 73280 | 73550 | 73790 | 73860 | 72436 | 71952 |
| 37 | 1038 | 122520 | 122180 | 122152 | 82637 | 83520 | 121943 | 121000 | 119709 |
| 38 | 1039 | 80929 | 80847 | 81755 | 122441 | 122196 | 83982 | 84528 | 85642 |
| 39 | 1040 | 193190 | 192276 | 191781 | 192119 | 191966 | 192151 | 192413 | 193315 |
| 40 | 1041 | 112908 | 111120 | 109858 | 109049 | 107797 | 106935 | 105588 | 104577 |
| 41 | 1042 | 183333 | 185987 | 188163 | 191536 | 194511 | 197063 | 200374 | 204532 |

Data Preprocessing

```
[13] 1 population.drop(['population60'], axis=1, inplace=True)

1 population

dcode  population48  population49  population50  population51  population52  population53  population54  population55  population56  population57  population58  population59  population61
0    1001      67357      65835      64356      62966      61374      60313      58771      57831      56684      55373      54195      52522      50382
1    1002     121336     119927     117867     116742     114488     111496     108815     107969     106811     104394     103230     98450      94854
2    1003     126126     133415     138667     143675     147668     151292     154371     157224     159962     162598     164494     167844     172990
3    1004      50023      49730      49124      48506      47503      47053      46087      46112      46114      46472      46606      47308      48207
4    1005     178986     181390     182335     183836     185901     188164     188252     189737     190544     190659     190528     190828     191323
5    1006     149093     149860     150139     150286     150166     149606     148645     148491     52613      51557      149070     148392     146841
6    1007      63192      62102      61040      60275      58858      57368      54996      53912      50092      49280      50852      49594      48382
7    1008      60001      58768      57461      56464      54601      53526      52093      50930      149056     148964     48615      47450      45701
8    1009      98564      98096      98496      97794      96880      95661      94482      93461      92774      92448      92206      91305      89237
9    1010     118019     122825     127727     131035     133149     135032     136236     137295     138661     139771     140335     141214     142311
10   1011     138327     142460     144800     147482     152528     157477     160850     163317     165724     168309     169517     171933     175662
11   1012      88556      88383      88061      87386      85789      84286      82481      81529      81162      80843      80381      79574      78031
12   1013      31674      31142      30646      30088      29283      28617      28001      27426      26932      26359      25863      24785      23655
13   1014      77232      77343      77202      76477      75493      74693      73533      73084      72495      72203      72283      72102      70341
14   1015     136971     134589     132034     129662     126883     124499     121539     119643     117536     115330     113622     111027     107754
15   1016      81727      80863      79637      78307      76608      75621      73864      72241      71087      70003      69543      67887      67211
16   1017      76213      76402      77033      76948      76987      77292      77720      78207      78943      80002      80549      81190      81689
17   1018      87853      86163      84821      82824      80894      79546      77471      76353      75765      75224      74836      73871      72171
18   1019     105730     106811     107812     107513     106963     106753     106786     106532     106192     105857     105585     105289     105047
19   1020     133669     132394     130540     129401     126823     124352     120032     117950     117503     116653     115479     112581     110417
20   1021     132313     137934     141698     145294     150492     155821     161642     165693     169614     173144     175829     179768     183878
21   1022     136240     135149     134407     133622     132670     131363     130493     129800     129559     129238     128581     127582     125981
```

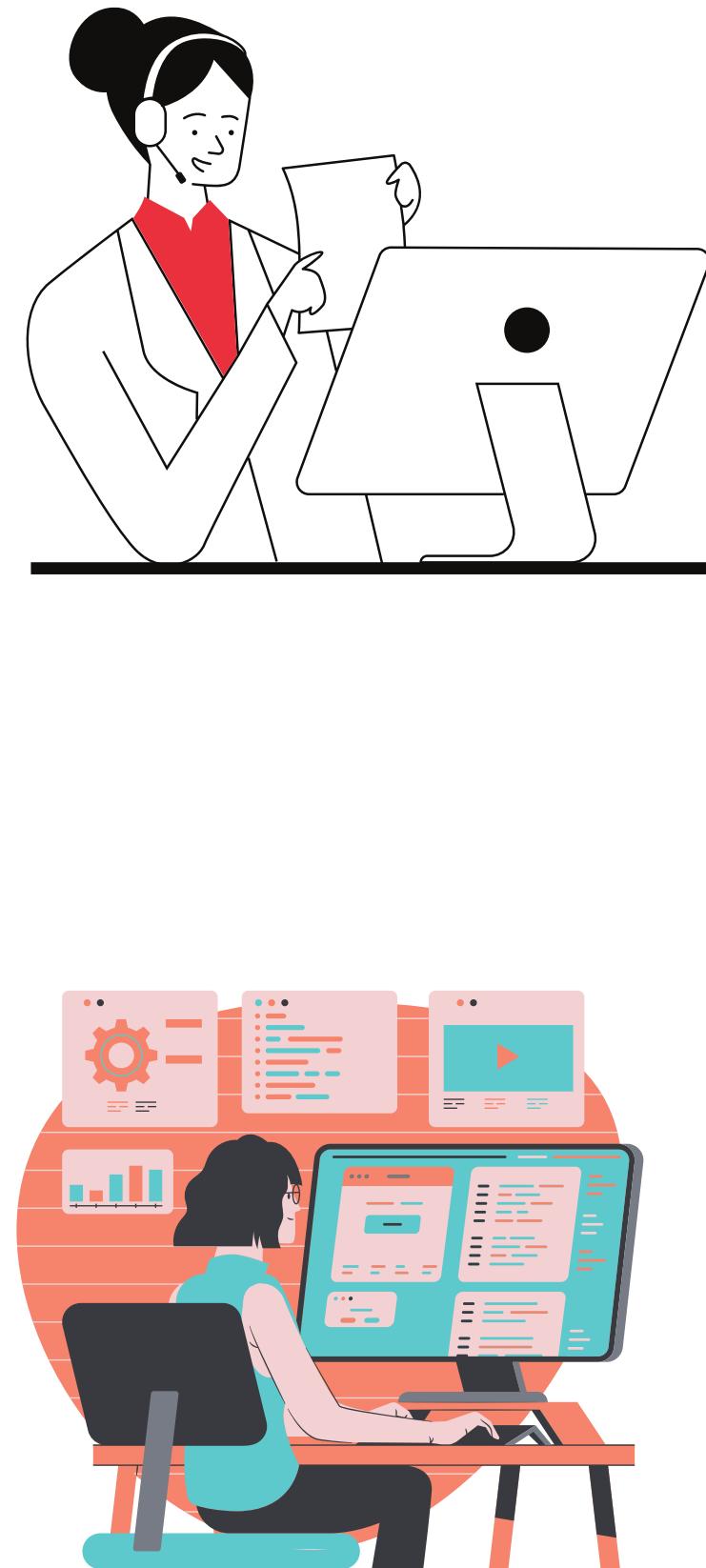


Data Preprocessing

```
[20] 1 moveinmoveout_new.drop(['movein60','moveout60'], axis=1, inplace=True)
```

```
1 moveinmoveout_new
```

| | dcode | movein52 | movein53 | movein54 | movein55 | movein56 | movein57 | movein58 | movein59 | movein61 | moveout52 | moveout53 | moveout54 | moveout55 | moveout56 | moveout57 | moveout58 | moveout59 | moveout61 |
|----|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 45 | 1001 | 3461 | 2965 | 2892 | 3189 | 2909 | 2647 | 2515 | 2815 | 2961 | 4341 | 3573 | 3842 | 3790 | 3543 | 3590 | 3589 | 3644 | 11239 |
| 3 | 1002 | 7534 | 7352 | 7890 | 7352 | 9233 | 6847 | 6430 | 9438 | 9040 | 10797 | 10796 | 10189 | 10379 | 12305 | 11474 | 11133 | 13091 | 4750 |
| 12 | 1003 | 11544 | 11400 | 11730 | 11498 | 11094 | 10765 | 10681 | 10747 | 10546 | 7294 | 7683 | 8410 | 8223 | 7920 | 7722 | 7611 | 7536 | 3373 |
| 47 | 1004 | 1878 | 1797 | 1626 | 1614 | 1649 | 1533 | 1499 | 1656 | 2288 | 5586 | 5191 | 5153 | 5582 | 6496 | 6043 | 5948 | 5967 | 5174 |
| 17 | 1005 | 16617 | 15512 | 14312 | 14858 | 13709 | 12711 | 12317 | 14337 | 7999 | 14262 | 13287 | 13711 | 13304 | 12965 | 12767 | 12299 | 13537 | 4890 |
| 8 | 1006 | 11369 | 9980 | 9547 | 9719 | 10213 | 9317 | 9292 | 9016 | 3396 | 11425 | 10915 | 10488 | 10134 | 9851 | 9852 | 9549 | 9826 | 3503 |
| 46 | 1007 | 2753 | 2880 | 2245 | 2170 | 2490 | 2173 | 2183 | 2016 | 2074 | 6138 | 6134 | 5804 | 5393 | 10630 | 9875 | 9502 | 8863 | 8308 |
| 48 | 1008 | 1797 | 1587 | 1441 | 1413 | 1380 | 1364 | 1249 | 1200 | 1222 | 4773 | 4340 | 4392 | 3992 | 3859 | 3852 | 3615 | 3340 | 6252 |
| 35 | 1009 | 5941 | 5243 | 5034 | 4873 | 4989 | 5266 | 5147 | 5586 | 4058 | 6129 | 5925 | 5532 | 5362 | 5123 | 5000 | 4846 | 5796 | 6820 |
| 9 | 1010 | 11085 | 10224 | 9786 | 9588 | 9840 | 9419 | 8969 | 8763 | 8070 | 10491 | 10444 | 10677 | 10677 | 12090 | 11916 | 12268 | 12231 | 8300 |
| 16 | 1011 | 16392 | 15118 | 14147 | 12587 | 12377 | 12478 | 11494 | 11843 | 11594 | 10844 | 9875 | 10210 | 9835 | 9526 | 9398 | 9167 | 9343 | 7026 |
| 38 | 1012 | 4799 | 4621 | 4300 | 4331 | 4636 | 4307 | 3981 | 4083 | 3537 | 5479 | 5476 | 5352 | 4871 | 4523 | 4257 | 4161 | 4188 | 7581 |
| 49 | 1013 | 1036 | 815 | 753 | 783 | 816 | 740 | 621 | 673 | 681 | 1330 | 1200 | 1097 | 1165 | 1143 | 1092 | 1083 | 1268 | 4281 |
| 33 | 1014 | 5667 | 5338 | 5467 | 5890 | 5773 | 5822 | 5438 | 6717 | 6447 | 7636 | 7098 | 7286 | 7772 | 7976 | 8278 | 7643 | 8460 | 10506 |
| 34 | 1015 | 6280 | 5297 | 5315 | 5180 | 4896 | 4685 | 4348 | 4521 | 4374 | 9975 | 8990 | 8852 | 8071 | 8105 | 8140 | 7642 | 7901 | 997 |
| 44 | 1016 | 3852 | 3577 | 3046 | 3141 | 2974 | 2956 | 2994 | 2486 | 10087 | 4611 | 4093 | 4083 | 4242 | 3583 | 3514 | 3212 | 3366 | 7760 |
| 32 | 1017 | 5248 | 5178 | 5480 | 5408 | 5400 | 5799 | 5699 | 6049 | 5326 | 6546 | 6312 | 6099 | 6544 | 6103 | 6174 | 6396 | 6943 | 5548 |
| 40 | 1018 | 4212 | 3802 | 4154 | 3562 | 3540 | 3410 | 15956 | 2959 | 2593 | 7528 | 6237 | 6673 | 5865 | 6202 | 6134 | 5508 | 5304 | 11486 |
| 22 | 1019 | 6378 | 5788 | 6497 | 5522 | 5224 | 5200 | 5045 | 4855 | 4644 | 6178 | 5401 | 5712 | 5191 | 4957 | 4903 | 4674 | 4413 | 10576 |
| 28 | 1020 | 7350 | 6144 | 5877 | 5294 | 5906 | 5717 | 5377 | 4505 | 13396 | 13673 | 12302 | 11912 | 11083 | 15897 | 15747 | 15834 | 14251 | 7914 |
| 20 | 1021 | 14546 | 16245 | 16665 | 13912 | 13611 | 13274 | 12968 | 12693 | 5293 | 9939 | 11869 | 11591 | 10680 | 10530 | 10476 | 10046 | 10256 | 6553 |
| 6 | 1022 | 9164 | 7597 | 8356 | 7142 | 6795 | 7173 | 6209 | 6107 | 5450 | 10295 | 9449 | 9650 | 8875 | 8741 | 9246 | 8749 | 8452 | 5686 |
| 14 | 1023 | 13146 | 12321 | 12791 | 11300 | 10798 | 10729 | 9852 | 9588 | 8835 | 9564 | 9528 | 9685 | 9322 | 9157 | 9296 | 8407 | 8410 | 6931 |
| 37 | 1024 | 5794 | 4679 | 4493 | 4228 | 4253 | 4345 | 4077 | 4031 | 4038 | 7779 | 6662 | 6451 | 6310 | 5908 | 6043 | 5601 | 5561 | 14121 |



Data Preprocessing

ตัด column ของปี 60 ออกทั้งตาราง garbage และ moveinmoveout

| | dcode | garbage53 | garbageperday53 | garbage54 | garbageperday54 | garbage55 | garbageperday55 | garbage56 | garbageperday56 | garbage57 | garbageperday57 | garbage58 | garbageperday58 | garbage59 | garbageperday59 | garbage61 | garbageperday61 |
|----|-------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|
| 0 | 1000 | 189819.45 | 520.05 | 122869.76 | 336.63 | 133599.00 | 365.02 | 206932.0 | 566.94 | 210940.80 | 577.92 | 217247.09 | 2.74 | 199522.73 | 545.14 | 219418.80 | 601.15 |
| 1 | 1001 | 69166.29 | 189.50 | 106149.08 | 290.82 | 119485.81 | 326.46 | 71844.4 | 196.83 | 69299.50 | 189.86 | 72019.02 | 197.31 | 70243.12 | 200.00 | 71372.82 | 195.54 |
| 2 | 1002 | 62244.26 | 170.53 | 105379.61 | 288.71 | 116.37 | 317.96 | 64255.4 | 176.04 | 62915.62 | 172.37 | 63580.71 | 174.19 | 63750.08 | 173.51 | 62186.37 | 170.37 |
| 3 | 1003 | 32339.16 | 88.60 | 95059.04 | 260.44 | 97084.32 | 265.26 | 40386.7 | 110.65 | 58888.59 | 161.34 | 43111.42 | 118.11 | 43545.74 | 131.30 | 50319.74 | 137.86 |
| 4 | 1004 | 54224.38 | 148.56 | 94655.76 | 259.33 | 100306.22 | 274.06 | 60767.8 | 166.49 | 94551.77 | 259.05 | 61746.75 | 169.17 | 58286.80 | 167.05 | 56632.20 | 155.16 |
| 5 | 1005 | 85742.96 | 234.91 | 87370.03 | 239.37 | 98955.18 | 270.37 | 93232.5 | 255.43 | 119561.54 | 327.57 | 99176.79 | 271.72 | 102066.16 | 302.24 | 112955.13 | 309.47 |
| 6 | 1006 | 101745.01 | 278.75 | 87276.00 | 239.11 | 92009.14 | 251.39 | 120589.0 | 330.38 | 102164.88 | 279.90 | 113420.03 | 310.74 | 106544.60 | 338.62 | 124970.88 | 342.39 |
| 7 | 1007 | 75719.25 | 207.45 | 86006.01 | 235.63 | 94435.68 | 258.02 | 104379.0 | 285.97 | 30773.10 | 84.31 | 104085.17 | 285.16 | 30383.52 | 309.70 | 111800.66 | 306.30 |
| 8 | 1008 | 32203.77 | 88.23 | 82532.46 | 226.12 | 99912.63 | 272.99 | 32474.1 | 88.97 | 56855.12 | 155.77 | 31207.79 | 85.50 | 117706.24 | 83.97 | 29790.81 | 81.62 |
| 9 | 1009 | 48978.52 | 134.19 | 78200.31 | 214.25 | 87574.21 | 239.27 | 56903.1 | 155.90 | 43346.67 | 118.76 | 54404.30 | 149.05 | 53592.83 | 147.54 | 53164.78 | 145.66 |
| 10 | 1010 | 60341.96 | 165.32 | 75249.90 | 206.16 | 84154.63 | 229.93 | 69510.6 | 190.44 | 70706.48 | 193.72 | 69591.76 | 190.66 | 69050.94 | 190.23 | 69576.22 | 190.62 |
| 11 | 1011 | 71764.46 | 196.61 | 73467.95 | 201.28 | 80198.83 | 219.12 | 88997.5 | 243.83 | 90386.71 | 247.63 | 93967.27 | 257.44 | 95759.88 | 285.68 | 109139.10 | 299.01 |
| 12 | 1012 | 58392.59 | 159.98 | 73220.38 | 200.60 | 61517.68 | 168.08 | 64938.8 | 177.91 | 64219.38 | 175.94 | 67058.97 | 183.72 | 67770.90 | 185.41 | 68049.42 | 186.44 |
| 13 | 1013 | 21238.74 | 58.19 | 70821.47 | 194.03 | 79376.40 | 216.88 | 21322.2 | 58.42 | 20630.96 | 56.52 | 21118.32 | 57.86 | 20401.97 | 56.48 | 19879.55 | 54.46 |
| 14 | 1014 | 54181.74 | 148.44 | 70297.58 | 192.60 | 71079.63 | 194.21 | 56694.5 | 155.33 | 56102.81 | 153.71 | 59333.23 | 162.56 | 60367.09 | 170.74 | 64478.78 | 176.65 |
| 15 | 1015 | 60352.95 | 165.35 | 70160.21 | 192.22 | 75129.41 | 205.27 | 59261.5 | 162.36 | 58793.52 | 161.08 | 59135.63 | 162.02 | 57750.21 | 163.06 | 59648.60 | 163.42 |
| 16 | 1016 | 31994.30 | 87.66 | 69971.85 | 191.70 | 70252.06 | 191.95 | 31028.6 | 85.01 | 29936.32 | 82.02 | 31169.03 | 85.39 | 29004.66 | 77.25 | 28806.92 | 78.92 |
| 17 | 1017 | 53821.52 | 147.46 | 69778.86 | 191.17 | 71742.58 | 196.02 | 72966.6 | 199.91 | 73513.35 | 201.41 | 70072.99 | 191.98 | 71851.82 | 212.64 | 83483.37 | 228.72 |
| 18 | 1018 | 43931.65 | 120.36 | 68184.05 | 186.81 | 71984.22 | 196.68 | 45999.2 | 126.03 | 45362.27 | 124.28 | 49075.86 | 134.45 | 46209.77 | 125.72 | 46112.37 | 126.34 |
| 19 | 1019 | 40731.33 | 111.59 | 65332.59 | 178.99 | 68452.05 | 187.03 | 44920.4 | 123.07 | 46197.79 | 126.57 | 48622.29 | 133.21 | 48360.44 | 143.20 | 54321.82 | 148.83 |
| 20 | 1020 | 66327.09 | 181.72 | 64951.63 | 177.95 | 73143.96 | 199.85 | 66923.3 | 183.35 | 68311.84 | 187.16 | 72829.51 | 199.53 | 70786.25 | 189.32 | 61571.42 | 168.69 |

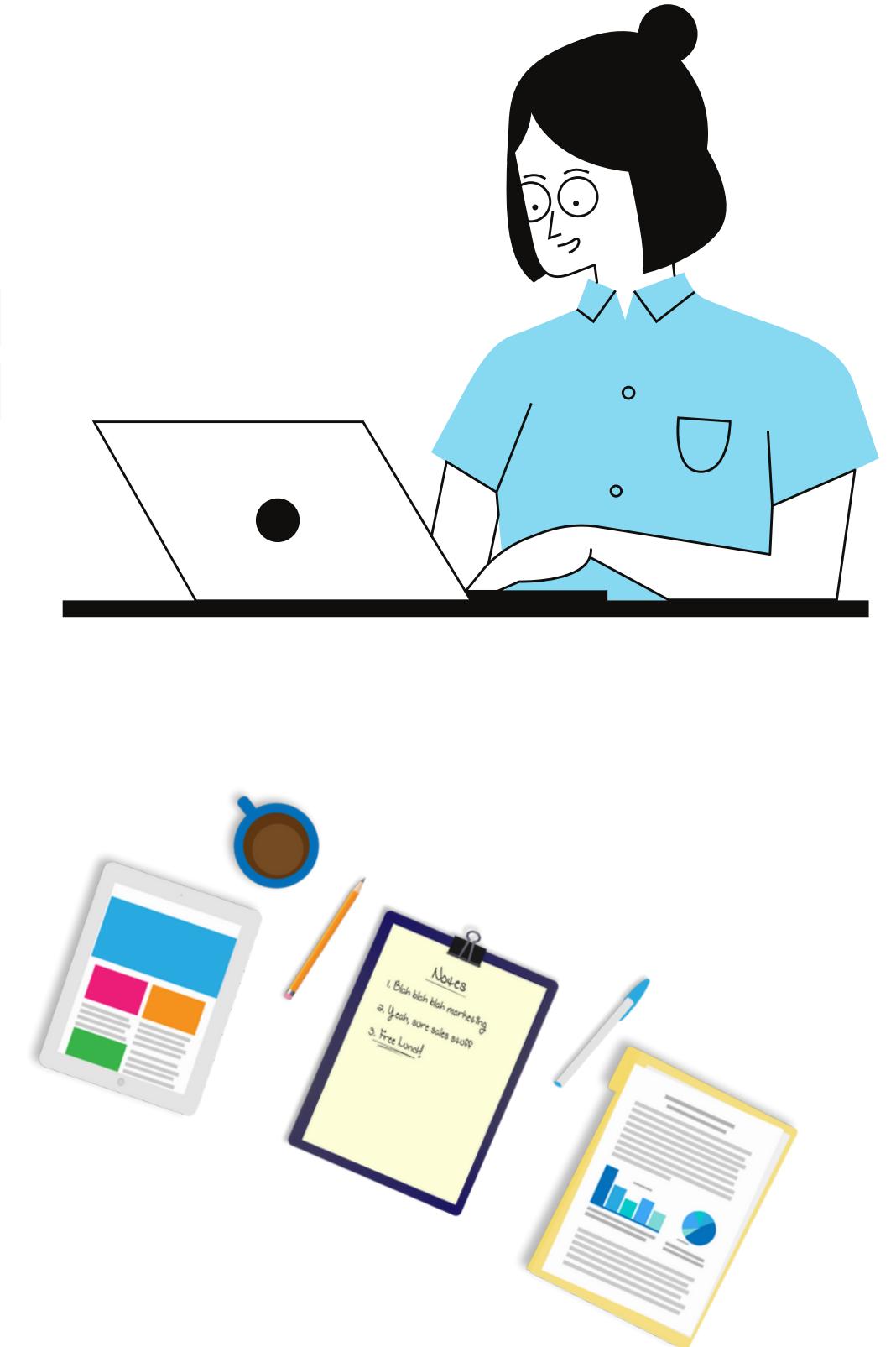
Data Preprocessing

ตัด column ปี 52 ออก เพราะต้องการตั้งแต่ปี 53

```
[22] 1 moveinmoveout_new.drop(['movein52','moveout52'], axis=1, inplace=True)
```

```
[23] 1 moveinmoveout_new
```

| | dcode | movein53 | movein54 | movein55 | movein56 | movein57 | movein58 | movein59 | movein61 | moveout53 | moveout54 | moveout55 | moveout56 | moveout57 | moveout58 | moveout59 | moveout61 |
|----|-------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 45 | 1001 | 2965 | 2892 | 3189 | 2909 | 2647 | 2515 | 2815 | 2961 | 3573 | 3842 | 3790 | 3543 | 3590 | 3589 | 3644 | 11239 |
| 3 | 1002 | 7352 | 7890 | 7352 | 9233 | 6847 | 6430 | 9438 | 9040 | 10796 | 10189 | 10379 | 12305 | 11474 | 11133 | 13091 | 4750 |
| 12 | 1003 | 11400 | 11730 | 11498 | 11094 | 10765 | 10681 | 10747 | 10546 | 7683 | 8410 | 8223 | 7920 | 7722 | 7611 | 7536 | 3373 |
| 47 | 1004 | 1797 | 1626 | 1614 | 1649 | 1533 | 1499 | 1656 | 2288 | 5191 | 5153 | 5582 | 6496 | 6043 | 5948 | 5967 | 5174 |
| 17 | 1005 | 15512 | 14312 | 14858 | 13709 | 12711 | 12317 | 14337 | 7999 | 13287 | 13711 | 13304 | 12965 | 12767 | 12299 | 13537 | 4890 |
| 8 | 1006 | 9980 | 9547 | 9719 | 10213 | 9317 | 9292 | 9016 | 3396 | 10915 | 10488 | 10134 | 9851 | 9852 | 9549 | 9826 | 3503 |
| 46 | 1007 | 2880 | 2245 | 2170 | 2490 | 2173 | 2183 | 2016 | 2074 | 6134 | 5804 | 5393 | 10630 | 9875 | 9502 | 8863 | 8308 |
| 48 | 1008 | 1587 | 1441 | 1413 | 1380 | 1364 | 1249 | 1200 | 1222 | 4340 | 4392 | 3992 | 3859 | 3852 | 3615 | 3340 | 6252 |
| 35 | 1009 | 5243 | 5034 | 4873 | 4989 | 5266 | 5147 | 5586 | 4058 | 5925 | 5532 | 5362 | 5123 | 5000 | 4846 | 5796 | 6820 |
| 9 | 1010 | 10224 | 9786 | 9588 | 9840 | 9419 | 8969 | 8763 | 8070 | 10444 | 10677 | 10677 | 12090 | 11916 | 12268 | 12231 | 8300 |
| 16 | 1011 | 15118 | 14147 | 12587 | 12377 | 12478 | 11494 | 11843 | 11594 | 9875 | 10210 | 9835 | 9526 | 9398 | 9167 | 9343 | 7026 |
| 38 | 1012 | 4621 | 4300 | 4331 | 4636 | 4307 | 3981 | 4083 | 3537 | 5476 | 5352 | 4871 | 4523 | 4257 | 4161 | 4188 | 7581 |
| 49 | 1013 | 815 | 753 | 783 | 816 | 740 | 621 | 673 | 681 | 1200 | 1097 | 1165 | 1143 | 1092 | 1083 | 1268 | 4281 |
| 33 | 1014 | 5338 | 5467 | 5890 | 5773 | 5822 | 5438 | 6717 | 6447 | 7098 | 7286 | 7772 | 7976 | 8278 | 7643 | 8460 | 10506 |
| 34 | 1015 | 5297 | 5315 | 5180 | 4896 | 4685 | 4348 | 4521 | 4374 | 8990 | 8852 | 8071 | 8105 | 8140 | 7642 | 7901 | 997 |
| 44 | 1016 | 3577 | 3046 | 3141 | 2974 | 2956 | 2994 | 2486 | 10087 | 4093 | 4083 | 4242 | 3583 | 3514 | 3212 | 3366 | 7760 |
| 32 | 1017 | 5178 | 5480 | 5408 | 5400 | 5799 | 5699 | 6049 | 5326 | 6312 | 6099 | 6544 | 6103 | 6174 | 6396 | 6943 | 5548 |
| 40 | 1018 | 3802 | 4154 | 3562 | 3540 | 3410 | 15956 | 2959 | 2593 | 6237 | 6673 | 5865 | 6202 | 6134 | 5508 | 5304 | 11486 |
| 22 | 1019 | 5788 | 6497 | 5522 | 5224 | 5200 | 5045 | 4855 | 4644 | 5401 | 5712 | 5191 | 4957 | 4903 | 4674 | 4413 | 10576 |
| 28 | 1020 | 6144 | 5877 | 5294 | 5906 | 5717 | 5377 | 4505 | 13396 | 12302 | 11912 | 11083 | 15897 | 15747 | 15834 | 14251 | 7914 |
| 20 | 1021 | 16245 | 16665 | 13912 | 13611 | 13274 | 12968 | 12693 | 5293 | 11869 | 11591 | 10680 | 10530 | 10476 | 10046 | 10256 | 6553 |
| 6 | 1022 | 7597 | 8356 | 7142 | 6795 | 7173 | 6209 | 6107 | 5450 | 9449 | 9650 | 8875 | 8741 | 9246 | 8749 | 8452 | 5686 |
| 14 | 1023 | 12321 | 12791 | 11300 | 10798 | 10729 | 9852 | 9588 | 8835 | 9528 | 9685 | 9322 | 9157 | 9296 | 8407 | 8410 | 6931 |



Data Preprocessing



```
[28] 1 tablepop_garb_moveinout = pd.merge(tablepop_garbage, moveinmoveout_new, how='left', on='dcode')
```

```
[29] 1 tablepop_garb_moveinout
```

| | dcode | population53 | population54 | population55 | population56 | population57 | population58 | population59 | population61 | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 | garbage61 | movein53 | movein54 | mov |
|----|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----|
| 0 | 1001 | 60313 | 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 50382 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.12 | 71372.82 | 2965 | 2892 | |
| 1 | 1002 | 111496 | 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 94854 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.08 | 62186.37 | 7352 | 7890 | |
| 2 | 1003 | 151292 | 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 172990 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.74 | 50319.74 | 11400 | 11730 | |
| 3 | 1004 | 47053 | 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 48207 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.80 | 56632.20 | 1797 | 1626 | |
| 4 | 1005 | 188164 | 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 191323 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.16 | 112955.13 | 15512 | 14312 | |
| 5 | 1006 | 149606 | 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 146841 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.60 | 124970.88 | 9980 | 9547 | |
| 6 | 1007 | 57368 | 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 48382 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.52 | 111800.66 | 2880 | 2245 | |
| 7 | 1008 | 53526 | 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 45701 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.24 | 29790.81 | 1587 | 1441 | |
| 8 | 1009 | 95661 | 94482 | 93461 | 92774 | 92448 | 92206 | 91305 | 89237 | 48978.52 | 78200.31 | 87574.21 | 56903.1 | 43346.67 | 54404.30 | 53592.83 | 53164.78 | 5243 | 5034 | |
| 9 | 1010 | 135032 | 136236 | 137295 | 138661 | 139771 | 140335 | 141214 | 142311 | 60341.96 | 75249.90 | 84154.63 | 69510.6 | 70706.48 | 69591.76 | 69050.94 | 69576.22 | 10224 | 9786 | |
| 10 | 1011 | 157477 | 160850 | 163317 | 165724 | 168309 | 169517 | 171933 | 175662 | 71764.46 | 73467.95 | 80198.83 | 88997.5 | 90386.71 | 93967.27 | 95759.88 | 109139.10 | 15118 | 14147 | |
| 11 | 1012 | 84286 | 82481 | 81529 | 81162 | 80843 | 80381 | 79574 | 78031 | 58392.59 | 73220.38 | 61517.68 | 64938.8 | 64219.38 | 67058.97 | 67770.90 | 68049.42 | 4621 | 4300 | |
| 12 | 1013 | 28617 | 28001 | 27426 | 26932 | 26359 | 25863 | 24785 | 23655 | 21238.74 | 70821.47 | 79376.40 | 21322.2 | 20630.96 | 21118.32 | 20401.97 | 19879.55 | 815 | 753 | |
| 13 | 1014 | 74693 | 73533 | 73084 | 72495 | 72203 | 72283 | 72102 | 70341 | 54181.74 | 70297.58 | 71079.63 | 56694.5 | 56102.81 | 59333.23 | 60367.09 | 64478.78 | 5338 | 5467 | |
| 14 | 1015 | 124499 | 121539 | 119643 | 117536 | 115330 | 113622 | 111027 | 107754 | 60352.95 | 70160.21 | 75129.41 | 59261.5 | 58793.52 | 59135.63 | 57750.21 | 59648.60 | 5297 | 5315 | |



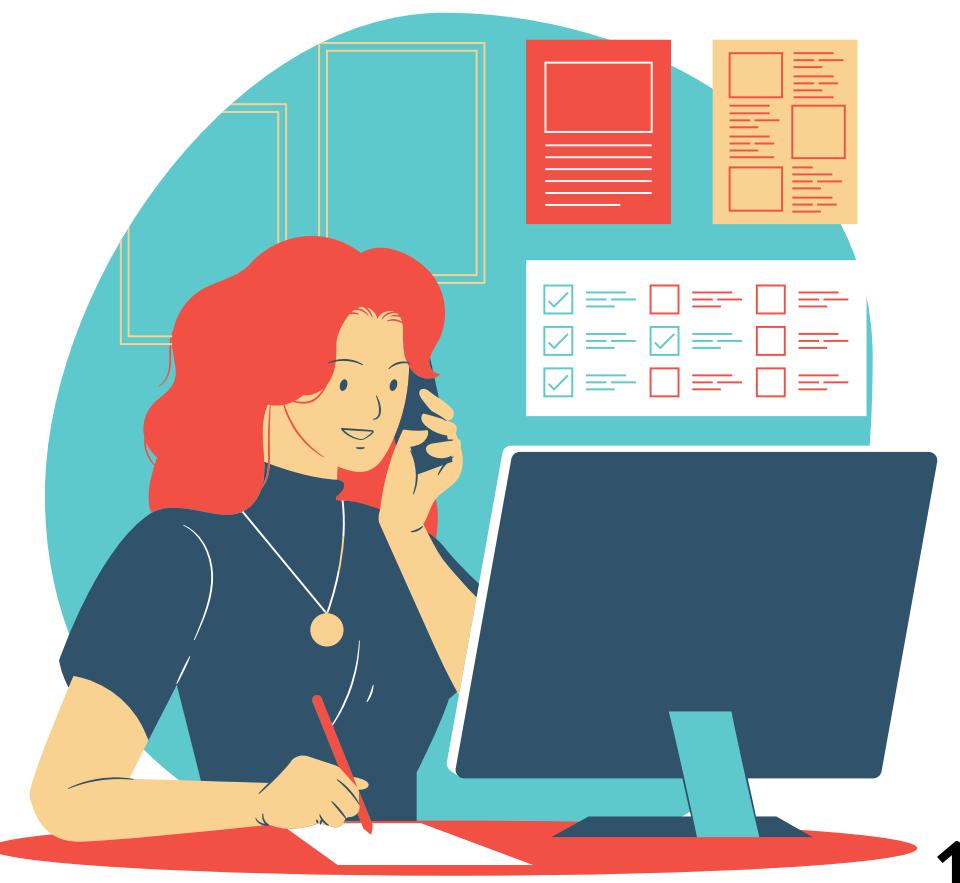
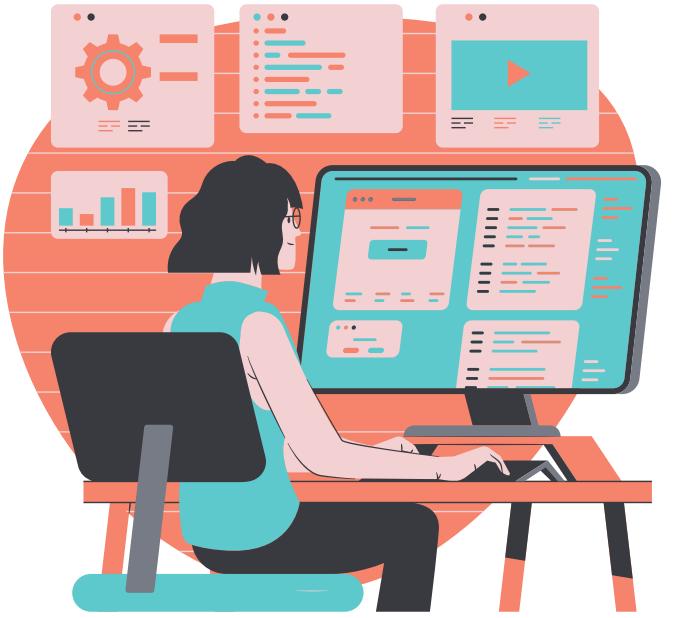
Data Preprocessing

ในตาราง garbage ตัด column garbageperday ของทุกปีออก เนื่องจากต้องการทราบเฉพาะปริมาณรวมขยะของแต่ละปี

```
[24] 1 garbage.drop(['garbageperday53', 'garbageperday54', 'garbageperday55', 'garbageperday56', 'garbageperday57', 'garbageperday58', 'garbageperday59', 'garbageperday61'], axis=1, inplace=True)
```

```
1 garbage
```

| | dcode | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 | garbage61 |
|----|-------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0 | 1000 | 189819.45 | 122869.76 | 133599.00 | 206932.0 | 210940.80 | 217247.09 | 199522.73 | 219418.80 |
| 1 | 1001 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.12 | 71372.82 |
| 2 | 1002 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.08 | 62186.37 |
| 3 | 1003 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.74 | 50319.74 |
| 4 | 1004 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.80 | 56632.20 |
| 5 | 1005 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.16 | 112955.13 |
| 6 | 1006 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.60 | 124970.88 |
| 7 | 1007 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.52 | 111800.66 |
| 8 | 1008 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.24 | 29790.81 |
| 9 | 1009 | 48978.52 | 78200.31 | 87574.21 | 56903.1 | 43346.67 | 54404.30 | 53592.83 | 53164.78 |
| 10 | 1010 | 60341.96 | 75249.90 | 84154.63 | 69510.6 | 70706.48 | 69591.76 | 69050.94 | 69576.22 |
| 11 | 1011 | 71764.46 | 73467.95 | 80198.83 | 88997.5 | 90386.71 | 93967.27 | 95759.88 | 109139.10 |
| 12 | 1012 | 58392.59 | 73220.38 | 61517.68 | 64938.8 | 64219.38 | 67058.97 | 67770.90 | 68049.42 |
| 13 | 1013 | 21238.74 | 70821.47 | 79376.40 | 21322.2 | 20630.96 | 21118.32 | 20401.97 | 19879.55 |
| 14 | 1014 | 54181.74 | 70297.58 | 71079.63 | 56694.5 | 56102.81 | 59333.23 | 60367.09 | 64478.78 |
| 15 | 1015 | 60352.95 | 70160.21 | 75129.41 | 59261.5 | 58793.52 | 59135.63 | 57750.21 | 59648.60 |
| 16 | 1016 | 31994.30 | 69971.85 | 70252.06 | 31028.6 | 29936.32 | 31169.03 | 29004.66 | 28806.92 |
| 17 | 1017 | 53821.52 | 69778.86 | 71742.58 | 72966.6 | 73513.35 | 70072.99 | 71851.82 | 83483.37 |
| 18 | 1018 | 43931.65 | 68184.05 | 71984.22 | 45999.2 | 45362.27 | 49075.86 | 46209.77 | 46112.37 |
| 19 | 1019 | 40731.33 | 65332.59 | 68452.05 | 44920.4 | 46197.79 | 48622.29 | 48360.44 | 54321.82 |
| 20 | 1020 | 66327.09 | 64951.63 | 73143.96 | 66923.3 | 68311.84 | 72829.51 | 70786.25 | 61571.42 |
| 21 | 1021 | 90380.85 | 64875.50 | 66280.12 | 101407.0 | 100637.34 | 107681.16 | 111452.97 | 122081.56 |
| 22 | 1022 | 54928.37 | 62503.79 | 66509.47 | 56241.6 | 56299.54 | 60826.77 | 58670.93 | 59137.82 |

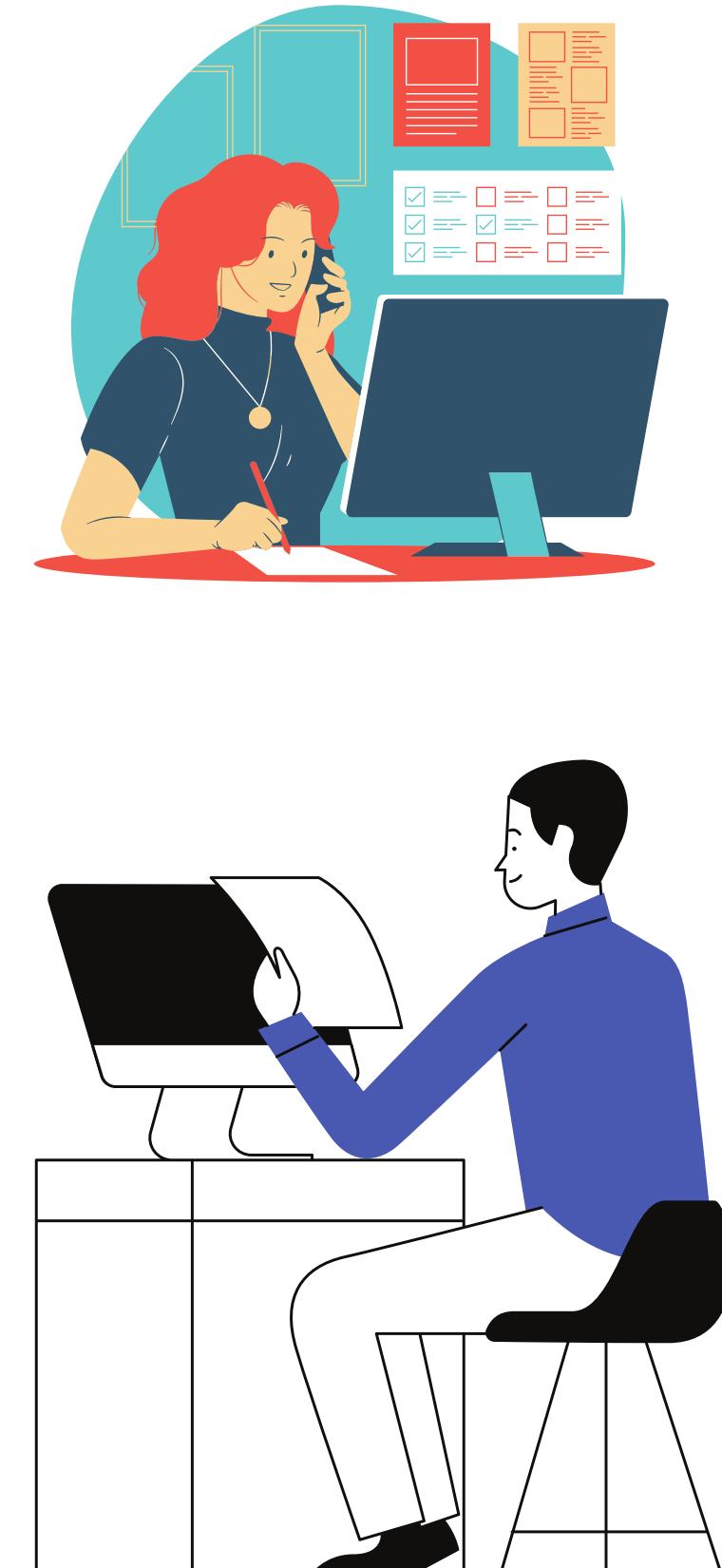


Data Preprocessing

รวมตาราง 2 ตารางเข้าด้วยกัน โดยให้ตาราง population เป็นตารางหลัก

```
1 merged_table = population.merge(garbage,how='left',left_on='dcode',right_on='dcode') #แบบอжаารย์  
2 merged_table
```

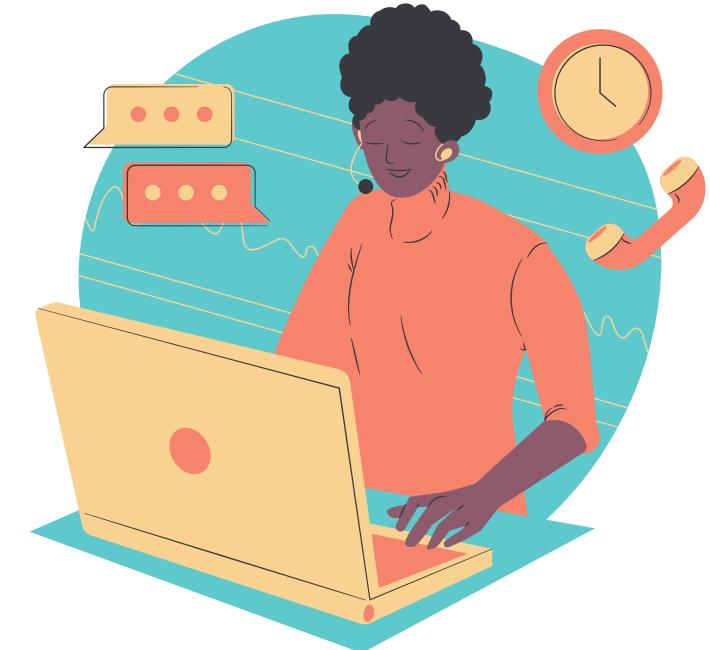
| | dcode | population53 | population54 | population55 | population56 | population57 | population58 | population59 | population61 | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 | garbage61 |
|----|-------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 0 | 1001 | 60313 | 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 50382 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.12 | 71372.82 |
| 1 | 1002 | 111496 | 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 94854 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.08 | 62186.37 |
| 2 | 1003 | 151292 | 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 172990 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.74 | 50319.74 |
| 3 | 1004 | 47053 | 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 48207 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.80 | 56632.20 |
| 4 | 1005 | 188164 | 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 191323 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.16 | 112955.13 |
| 5 | 1006 | 149606 | 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 146841 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.60 | 124970.88 |
| 6 | 1007 | 57368 | 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 48382 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.52 | 111800.66 |
| 7 | 1008 | 53526 | 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 45701 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.24 | 29790.81 |
| 8 | 1009 | 95661 | 94482 | 93461 | 92774 | 92448 | 92206 | 91305 | 89237 | 48978.52 | 78200.31 | 87574.21 | 56903.1 | 43346.67 | 54404.30 | 53592.83 | 53164.78 |
| 9 | 1010 | 135032 | 136236 | 137295 | 138661 | 139771 | 140335 | 141214 | 142311 | 60341.96 | 75249.90 | 84154.63 | 69510.6 | 70706.48 | 69591.76 | 69050.94 | 69576.22 |
| 10 | 1011 | 157477 | 160850 | 163317 | 165724 | 168309 | 169517 | 171933 | 175662 | 71764.46 | 73467.95 | 80198.83 | 88997.5 | 90386.71 | 93967.27 | 95759.88 | 109139.10 |
| 11 | 1012 | 84286 | 82481 | 81529 | 81162 | 80843 | 80381 | 79574 | 78031 | 58392.59 | 73220.38 | 61517.68 | 64938.8 | 64219.38 | 67058.97 | 67770.90 | 68049.42 |
| 12 | 1013 | 28617 | 28001 | 27426 | 26932 | 26359 | 25863 | 24785 | 23655 | 21238.74 | 70821.47 | 79376.40 | 21322.2 | 20630.96 | 21118.32 | 20401.97 | 19879.55 |
| 13 | 1014 | 74693 | 73533 | 73084 | 72495 | 72203 | 72283 | 72102 | 70341 | 54181.74 | 70297.58 | 71079.63 | 56694.5 | 56102.81 | 59333.23 | 60367.09 | 64478.78 |
| 14 | 1015 | 124499 | 121539 | 119643 | 117536 | 115330 | 113622 | 111027 | 107754 | 60352.95 | 70160.21 | 75129.41 | 59261.5 | 58793.52 | 59135.63 | 57750.21 | 59648.60 |
| 15 | 1016 | 75621 | 73864 | 72241 | 71087 | 70003 | 69543 | 67887 | 67211 | 31994.30 | 69971.85 | 70252.06 | 31028.6 | 29936.32 | 31169.03 | 29004.66 | 28806.92 |
| 16 | 1017 | 77292 | 77720 | 78207 | 78943 | 80002 | 80549 | 81190 | 81689 | 53821.52 | 69778.86 | 71742.58 | 72966.6 | 73513.35 | 70072.99 | 71851.82 | 83483.37 |
| 17 | 1018 | 79546 | 77471 | 76353 | 75765 | 75224 | 74836 | 73871 | 72171 | 43931.65 | 68184.05 | 71984.22 | 45999.2 | 45362.27 | 49075.86 | 46209.77 | 46112.37 |
| 18 | 1019 | 106753 | 106786 | 106532 | 106192 | 105857 | 105585 | 105289 | 105047 | 40731.33 | 65332.59 | 68452.05 | 44920.4 | 46197.79 | 48622.29 | 48360.44 | 54321.82 |
| 19 | 1020 | 124352 | 120032 | 117950 | 117503 | 116653 | 115479 | 112581 | 110417 | 66327.09 | 64951.63 | 73143.96 | 66923.3 | 68311.84 | 72829.51 | 70786.25 | 61571.42 |
| 20 | 1021 | 155821 | 161642 | 165693 | 169614 | 173144 | 175829 | 179768 | 183878 | 90380.85 | 64875.50 | 66280.12 | 101407.0 | 100637.34 | 107681.16 | 111452.97 | 122081.56 |
| 21 | 1022 | 131363 | 130493 | 129800 | 129559 | 129238 | 128581 | 127582 | 125981 | 54928.37 | 62503.79 | 66509.47 | 56241.6 | 56299.54 | 60826.77 | 58670.93 | 59137.82 |
| 22 | 1023 | 145361 | 148298 | 150285 | 151877 | 153175 | 154018 | 155229 | 156267 | 58451.80 | 60880.44 | 62531.84 | 62327.9 | 63247.08 | 63411.89 | 61380.55 | 64632.91 |
| 23 | 1024 | 89297 | 87841 | 86643 | 85825 | 84881 | 84256 | 83248 | 81806 | 42815.74 | 59626.21 | 62931.45 | 42008.5 | 42497.82 | 41717.52 | 41835.00 | 43423.98 |



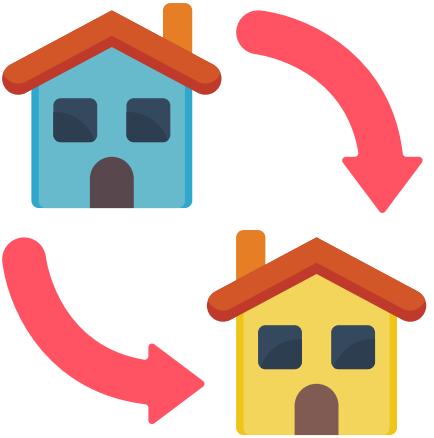
Data Preprocessing

```
i.merge(tablepop_garbage, moveinmoveout_new, how='left', on='dcode')
```

| station54 | population55 | population56 | population57 | population58 | population59 | population61 | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 |
|-----------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 50382 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.1 |
| 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 94854 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.0 |
| 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 172990 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.7 |
| 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 48207 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.8 |
| 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 191323 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.1 |
| 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 146841 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.6 |
| 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 48382 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.5 |
| 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 45701 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.2 |
| 94482 | 93461 | 92774 | 92448 | 92206 | 91305 | 89237 | 48978.52 | 78200.31 | 87574.21 | 56903.1 | 43346.67 | 54404.30 | 53592.8 |
| 136236 | 137295 | 138661 | 139771 | 140335 | 141214 | 142311 | 60341.96 | 75249.90 | 84154.63 | 69510.6 | 70706.48 | 69591.76 | 69050.9 |
| 160850 | 163317 | 165724 | 168309 | 169517 | 171933 | 175662 | 71764.46 | 73467.95 | 80198.83 | 88997.5 | 90386.71 | 93967.27 | 95759.8 |
| 82481 | 81529 | 81162 | 80843 | 80381 | 79574 | 78031 | 58392.59 | 73220.38 | 61517.68 | 64938.8 | 64219.38 | 67058.97 | 67770.9 |
| 28001 | 27426 | 26932 | 26359 | 25863 | 24785 | 23655 | 21238.74 | 70821.47 | 79376.40 | 21322.2 | 20630.96 | 21118.32 | 20401.9 |
| 73533 | 73084 | 72495 | 72203 | 72283 | 72102 | 70341 | 54181.74 | 70297.58 | 71079.63 | 56694.5 | 56102.81 | 59333.23 | 60367.0 |
| 121539 | 119643 | 117536 | 115330 | 113622 | 111027 | 107754 | 60352.95 | 70160.21 | 75129.41 | 59261.5 | 58793.52 | 59135.63 | 57750.2 |



ห้าข้อมูลมาเพิ่ม



- เพิ่มเดิม - เพิ่มชื่อเขตแต่ละเขตว่าชื่ออะไรบ้าง และหาค่าที่หายไป

```
[32] 1 district = pd.read_csv(os.path.join(path, 'district.csv'))
```

- ตารางชื่อเขตภายในกรุงเทพมหานคร

```
[33] 1 district
```

| | dcode | dname |
|----|-------|-------------------|
| 0 | 1001 | พระนคร |
| 1 | 1002 | คลอง |
| 2 | 1003 | หนองจอก |
| 3 | 1004 | บางซัก |
| 4 | 1005 | บางเขน |
| 5 | 1006 | บางกะปิ |
| 6 | 1007 | ปทุมวัน |
| 7 | 1008 | ป้อมปราบศัตรูพ่าย |
| 8 | 1009 | พระโขนง |
| 9 | 1010 | มีนบุรี |
| 10 | 1011 | ลาดกระบัง |
| 11 | 1012 | ยานนาวา |
| 12 | 1013 | สัมพันธวงศ์ |
| 13 | 1014 | พญาไท |
| 14 | 1015 | ธนบุรี |
| 15 | 1016 | บางกอกใหญ่ |
| 16 | 1017 | ทวายขาว |
| 17 | 1018 | คลองสาน |
| 18 | 1019 | คลองเตย |
| 19 | 1020 | บางกอกน้อย |
| 20 | 1021 | บางขุนเทียน |

dcode = PK ของตาราง คือรหัสเขตภายในกรุงเทพมหานคร

dname = FK ของตาราง คือชื่อเขตภายในกรุงเทพมหานคร

รวมตาราง population, garbage และ moveinmoveout

```
[41]: 1 pop_gar_moveinout = pd.merge(pop_gar, moveinmoveout_new, how='left', on='dcode')
2 pop_gar_moveinout
```

| | dcode | dname | population53 | population54 | population55 | population56 | population57 | population58 | population59 | population61 | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 | garbage61 | movein53 |
|----|-------|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|
| 0 | 1001 | พระนคร | 60313 | 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 50382 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.12 | 71372.82 | 2965 |
| 1 | 1002 | คุสิต | 111496 | 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 94854 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.08 | 62186.37 | 7351 |
| 2 | 1003 | หนองจอก | 151292 | 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 172990 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.74 | 50319.74 | 1140 |
| 3 | 1004 | บางรัก | 47053 | 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 48207 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.80 | 56632.20 | 1791 |
| 4 | 1005 | บางเขน | 188164 | 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 191323 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.16 | 112955.13 | 1551 |
| 5 | 1006 | บางกะปิ | 149606 | 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 146841 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.60 | 124970.88 | 9980 |
| 6 | 1007 | ปทุมวัน | 57368 | 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 48382 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.52 | 111800.66 | 2880 |
| 7 | 1008 | ป้อมปราบศรีพายัพ | 53526 | 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 45701 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.24 | 29790.81 | 1581 |
| 8 | 1009 | พระโขนง | 95661 | 94482 | 93461 | 92774 | 92448 | 92206 | 91305 | 89237 | 48978.52 | 78200.31 | 87574.21 | 56903.1 | 43346.67 | 54404.30 | 53592.83 | 53164.78 | 5240 |
| 9 | 1010 | มีนบุรี | 135032 | 136236 | 137295 | 138661 | 139771 | 140335 | 141214 | 142311 | 60341.96 | 75249.90 | 84154.63 | 69510.6 | 70706.48 | 69591.76 | 69050.94 | 69576.22 | 1022 |
| 10 | 1011 | ลาดกระบัง | 157477 | 160850 | 163317 | 165724 | 168309 | 169517 | 171933 | 175662 | 71764.46 | 73467.95 | 80198.83 | 88997.5 | 90386.71 | 93967.27 | 95759.88 | 109139.10 | 1511 |
| 11 | 1012 | ยานนาวา | 84286 | 82481 | 81529 | 81162 | 80843 | 80381 | 79574 | 78031 | 58392.59 | 73220.38 | 61517.68 | 64938.8 | 64219.38 | 67058.97 | 67770.90 | 68049.42 | 462 |
| 12 | 1013 | สัมพันธวงศ์ | 28617 | 28001 | 27426 | 26932 | 26359 | 25863 | 24785 | 23655 | 21238.74 | 70821.47 | 79376.40 | 21322.2 | 20630.96 | 21118.32 | 20401.97 | 19879.55 | 81 |
| 13 | 1014 | พญาไท | 74693 | 73533 | 73084 | 72495 | 72203 | 72283 | 72102 | 70341 | 54181.74 | 70297.58 | 71079.63 | 56694.5 | 56102.81 | 59333.23 | 60367.09 | 64478.78 | 5338 |
| 14 | 1015 | ธนบุรี | 124499 | 121539 | 119643 | 117536 | 115330 | 113622 | 111027 | 107754 | 60352.95 | 70160.21 | 75129.41 | 59261.5 | 58793.52 | 59135.63 | 57750.21 | 59648.60 | 5291 |
| 15 | 1016 | บางกอกใหญ่ | 75621 | 73864 | 72241 | 71087 | 70003 | 69543 | 67887 | 67211 | 31994.30 | 69971.85 | 70252.06 | 31028.6 | 29936.32 | 31169.03 | 29004.66 | 28806.92 | 3571 |
| 16 | 1017 | ทัพยานหง | 77292 | 77720 | 78207 | 78943 | 80002 | 80549 | 81190 | 81689 | 53821.52 | 69778.86 | 71742.58 | 72966.6 | 73513.35 | 70072.99 | 71851.82 | 83483.37 | 5178 |
| 17 | 1018 | คลองสาน | 79546 | 77471 | 76353 | 75765 | 75224 | 74836 | 73871 | 72171 | 43931.65 | 68184.05 | 71984.22 | 45999.2 | 45362.27 | 49075.86 | 46209.77 | 46112.37 | 3802 |

dcode = PK ของตาราง คือเขตภายในกรุงเทพมหานคร

dname = FK ของตาราง คือชื่อเขตภายในกรุงเทพมหานคร

population53 = จำนวนประชากรคนกรุงเทพในปี 2553

garbage53 = ปริมาณขยะของกรุงเทพในปี 2553

movein = จำนวนคนที่ย้ายเข้ากรุงเทพในปี 2553

moveout = จำนวนคนที่ย้ายออกจากรุงเทพในปี 2553 เป็นต้น





Final Project

ข้อมูลเพิ่มเติม เนื่องจากข้อมูลเดิมไม่เพียงพอสำหรับการทำนาย

```
✓ [45] 1 import pandas as pd #ทำงานกับข้อมูลลักษณะตาราง
✓ [45] 1 from google.colab import drive #เชื่อมเข้ากับ Drive
2 drive.mount('/content/drive') # คลิกที่ลิงก์ -> เลือก E-mail -> ลงชื่อเข้าใช้ -> ก็อปปี้ลิงค์ -> นำกลับมาวางในช่องว่าง -> กด enter
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).

✓ [46] 1 import os # os เอาไว้จัดการไฟล์และ path
✓ [47] 1 path = '/content/drive/My_Drive/DWDM2021_DATA'
✓ [48] 1 park = pd.read_csv(os.path.join(path, 'park.csv')) #เพิ่มข้อมูลจำนวนสวนสาธารณะเข้ามา
✓ [49] 1 park

dcode num_park54 num_park55 num_park56 num_park57 num_park58 num_park59 num_park60 num_park61 num_park62 area_park54 area_park55 area_park56 area_park57 area_park58 area_park59 area_park60 area_park61 area_park62
0 1001 89 95 97 98 108 111 0 0 113 401221.81 563001.81 567070.0 568117.81 585157.81 606289.56 0.0 0.0 627595.56
1 1002 100 103 106 108 115 115 0 0 123 361593.19 363253.19 364333.0 365977.19 367809.19 361269.19 0.0 0.0 1185376.00
2 1003 176 186 192 199 171 178 0 0 195 1162283.75 1268683.75 1329480.0 1394382.00 1329438.00 1376232.25 0.0 0.0 1424230.25
3 1004 144 168 191 211 233 243 0 0 268 87102.04 103108.04 112934.0 120068.04 126519.04 133979.05 0.0 0.0 154968.77
4 1005 43 44 54 62 68 72 0 0 76 474789.53 482989.53 536238.0 572784.00 665448.00 815448.00 0.0 0.0 1032750.75
5 1006 119 121 127 136 143 157 0 0 172 644095.50 646015.50 742432.0 765112.38 770133.81 793635.31 0.0 0.0 810526.56
6 1007 96 99 104 106 115 122 0 0 133 699892.13 700621.13 715021.0 713280.00 757036.00 776160.00 0.0 0.0 896952.00
7 1008 131 133 136 142 146 112 0 0 116 265522.59 263601.00 264005.0 271279.00 274299.00 256314.64 0.0 0.0 256912.64
8 1009 299 309 332 336 337 332 0 0 345 243367.77 247015.77 257960.0 261424.00 274561.75 279470.22 0.0 0.0 288507.78
9 1010 123 142 165 196 215 226 0 0 167 755547.25 876187.25 985987.0 1076918.25 1219158.25 1248934.75 0.0 0.0 764297.25
10 1011 94 99 99 107 118 114 0 0 164 494749.00 499949.00 502749.0 515804.00 434832.38 410592.38 0.0 0.0 486265.09
11 1012 154 185 199 203 212 215 0 0 238 452777.16 462764.75 477860.0 465028.00 475464.00 489892.00 0.0 0.0 533186.69
```

เลือกมาเฉพาะจำนวนสวนสาธารณะของปี 59

```
[50] 1 park59 = park.iloc[:,[0,6]]
```

เลือกแคปปิทสันใจคือปี 2559

```
✓ [50] 1 park59
```

| | dcode | num_park59 |
|----|-------|------------|
| 0 | 1001 | 111 |
| 1 | 1002 | 115 |
| 2 | 1003 | 178 |
| 3 | 1004 | 243 |
| 4 | 1005 | 72 |
| 5 | 1006 | 157 |
| 6 | 1007 | 122 |
| 7 | 1008 | 112 |
| 8 | 1009 | 332 |
| 9 | 1010 | 226 |
| 10 | 1011 | 114 |
| 11 | 1012 | 215 |
| 12 | 1013 | 97 |

```
[52] 1 park59.isnull().any() #.isnull เพื่อคุณ missing และพบว่าไม่มีค่า missing
```

```
dcode      False  
num_park59  False  
dtype: bool
```

```
1 data2 = pd.merge(pop_gar_moveinout, park59, how='left', on='dcode')  
2 data2  
3 #เมื่อมีการข้อมูล pop_gar_moveinout กับตาราง park59
```

| | dcode | dname | population53 | population54 | population55 | population56 | population57 | population58 | population59 | population61 | garbage53 | garbage54 | garbage55 | garbage56 | garbage57 | garbage58 | garbage59 | garbage61 | movein5: |
|---|-------|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|
| 0 | 1001 | พระนคร | 60313 | 58771 | 57831 | 56684 | 55373 | 54195 | 52522 | 50382 | 69166.29 | 106149.08 | 119485.81 | 71844.4 | 69299.50 | 72019.02 | 70243.12 | 71372.82 | 2968 |
| 1 | 1002 | คุ้งตะเภา | 111496 | 108815 | 107969 | 106811 | 104394 | 103230 | 98450 | 94854 | 62244.26 | 105379.61 | 116.37 | 64255.4 | 62915.62 | 63580.71 | 63750.08 | 62186.37 | 7351 |
| 2 | 1003 | หนองจอก | 151292 | 154371 | 157224 | 159962 | 162598 | 164494 | 167844 | 172990 | 32339.16 | 95059.04 | 97084.32 | 40386.7 | 58888.59 | 43111.42 | 43545.74 | 50319.74 | 11400 |
| 3 | 1004 | บางรัก | 47053 | 46087 | 46112 | 46114 | 46472 | 46606 | 47308 | 48207 | 54224.38 | 94655.76 | 100306.22 | 60767.8 | 94551.77 | 61746.75 | 58286.80 | 56632.20 | 1791 |
| 4 | 1005 | นางยวน | 188164 | 188252 | 189737 | 190544 | 190659 | 190528 | 190828 | 191323 | 85742.96 | 87370.03 | 98955.18 | 93232.5 | 119561.54 | 99176.79 | 102066.16 | 112955.13 | 15512 |
| 5 | 1006 | บางกะปิ | 149606 | 148645 | 148491 | 52613 | 51557 | 149070 | 148392 | 146841 | 101745.01 | 87276.00 | 92009.14 | 120589.0 | 102164.88 | 113420.03 | 106544.60 | 124970.88 | 9980 |
| 6 | 1007 | ปทุมธานี | 57368 | 54996 | 53912 | 50092 | 49280 | 50852 | 49594 | 48382 | 75719.25 | 86006.01 | 94435.68 | 104379.0 | 30773.10 | 104085.17 | 30383.52 | 111800.66 | 2880 |
| 7 | 1008 | ป้อมปราบศัตรูพ่าย | 53526 | 52093 | 50930 | 149056 | 148964 | 48615 | 47450 | 45701 | 32203.77 | 82532.46 | 99912.63 | 32474.1 | 56855.12 | 31207.79 | 117706.24 | 29790.81 | 1581 |
| 8 | 1009 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |



```
1 data59_2 = data2[['dcode','dname','population59','garbage59','movein59','moveout59','num_park59']]  
2 data59_2  
3  
4 #เลือกเฉพาะcolumn ที่เป็นปี 59
```

| | dcode | dname | population59 | garbage59 | movein59 | moveout59 | num_park59 |
|----|-------|-------------------|--------------|-----------|----------|-----------|------------|
| 0 | 1001 | พระนคร | 52522 | 70243.12 | 2815 | 3644 | 111 |
| 1 | 1002 | ดุสิต | 98450 | 63750.08 | 9438 | 13091 | 115 |
| 2 | 1003 | หนองจอก | 167844 | 43545.74 | 10747 | 7536 | 178 |
| 3 | 1004 | บางรัก | 47308 | 58286.80 | 1656 | 5967 | 243 |
| 4 | 1005 | บางเขน | 190828 | 102066.16 | 14337 | 13537 | 72 |
| 5 | 1006 | บางกะปิ | 148392 | 106544.60 | 9016 | 9826 | 157 |
| 6 | 1007 | ปทุมธานี | 49594 | 30383.52 | 2016 | 8863 | 122 |
| 7 | 1008 | ป้อมปราบศัตรูพ่าย | 47450 | 117706.24 | 1200 | 3340 | 112 |
| 8 | 1009 | พระโขนง | 91305 | 53592.83 | 5586 | 5796 | 332 |
| 9 | 1010 | มีนบุรี | 141214 | 69050.94 | 8763 | 12231 | 226 |
| 10 | 1011 | ลาดกระบัง | 171933 | 95759.88 | 11843 | 9343 | 114 |
| 11 | 1012 | ยานนาวา | 79574 | 67770.90 | 4083 | 4188 | 215 |
| 12 | 1013 | สัมพันธวงศ์ | 24785 | 20401.97 | 673 | 1268 | 97 |
| 13 | 1014 | พญาไท | 72102 | 60367.09 | 6717 | 8460 | 71 |
| 14 | 1015 | ธนบุรี | 111027 | 57750.21 | 4521 | 7901 | 126 |
| 15 | 1016 | บางกอกใหญ่ | 67887 | 29004.66 | 2486 | 3366 | 100 |
| 16 | 1017 | ห้วยขวาง | 81190 | 71851.82 | 6049 | 6943 | 107 |
| 17 | 1018 | คลองสาน | 73871 | 46209.77 | 2959 | 5304 | 131 |

```
✓ 1 data59_2.isnull().any() #หาค่าmissing ปรากฏว่าไม่มีค่า missing เลย  
0s  
dcode      False  
dname      False  
population59  False  
garbage59  False  
movein59  False  
moveout59  False  
num_park59  False  
dtype: bool
```



เพิ่ม column AmountofGarbage

แบ่งปริมาณขยะ ในคอลัมน์ garbage59 เป็น

ปริมาณขยะน้อยมีค่า 0 - 50,000

ปริมาณขยะปานกลางมีค่า ระหว่าง 50,000 - 100,000

ปริมาณขยะมากมีค่า 100,000 - 150,000

```
[56] 1 from pandas.api.types import CategoricalDtype #import มาเพื่อแบ่ง Category ของปริมาณขยะ
```

```
[59] 1 Amount2 = ['low','median','high']
2 data59_2['Amount0fGarbage'] = pd.cut(data59_2.garbage59,
3 bins=[0,50000,100000,150000],
4 labels=Amount2,
5 right=False).astype(str).astype(CategoricalDtype(Amount2,ordered=True))
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user\_guide/indexing.html#returning-a-view-versus-a-copy
"""
```

1 data59_2

| | dcode | dname | population59 | garbage59 | movein59 | moveout59 | num_park59 | Amount0fGarbage |
|----|-------|-------------------|--------------|-----------|----------|-----------|------------|-----------------|
| 0 | 1001 | พะนัง | 52522 | 70243.12 | 2815 | 3644 | 111 | median |
| 1 | 1002 | ศรีสะเกษ | 98450 | 63750.08 | 9438 | 13091 | 115 | median |
| 2 | 1003 | หนองจอก | 167844 | 43545.74 | 10747 | 7536 | 178 | low |
| 3 | 1004 | นางรักษ์ | 47308 | 58286.80 | 1656 | 5967 | 243 | median |
| 4 | 1005 | นางเขน | 190828 | 102066.16 | 14337 | 13537 | 72 | high |
| 5 | 1006 | นางกะปี | 148392 | 106544.60 | 9016 | 9826 | 157 | high |
| 6 | 1007 | ปทุมธานี | 49594 | 30383.52 | 2016 | 8863 | 122 | low |
| 7 | 1008 | ป้อมปราบศัตรูพ่าย | 47450 | 117706.24 | 1200 | 3340 | 112 | high |
| 8 | 1009 | พระโขนง | 91305 | 53592.83 | 5586 | 5796 | 332 | median |
| 9 | 1010 | เมืองนนทบุรี | 141214 | 69050.94 | 8763 | 12231 | 226 | median |
| 10 | 1011 | ลาดกระบัง | 171933 | 95759.88 | 11843 | 9343 | 114 | median |
| 11 | 1012 | ยานนาวา | 79574 | 67770.90 | 4083 | 4188 | 215 | median |
| 12 | 1013 | สัมพันธวงศ์ | 24785 | 20401.97 | 673 | 1268 | 97 | low |
| 13 | 1014 | พญาไท | 72102 | 60367.09 | 6717 | 8460 | 71 | median |
| 14 | 1015 | ธนบุรี | 111027 | 57750.21 | 4521 | 7901 | 126 | median |
| 15 | 1016 | บางกอกใหญ่ | 67887 | 29004.66 | 2486 | 3366 | 100 | low |
| 16 | 1017 | ห้วยขวาง | 81190 | 71851.82 | 6049 | 6943 | 107 | median |
| 17 | 1018 | คลองสาน | 73871 | 46209.77 | 2959 | 5304 | 131 | low |
| 18 | 1019 | คลองชัก | 105289 | 48360.44 | 4855 | 4413 | 199 | low |

```
[61] 1 data59_2['AmountOfGarbage'] = data59_2['AmountOfGarbage'].map({'low':1,'median':2,'high':3})
2 data59_2
3 #.map ทำการเปลี่ยน low median high เป็นตัวเลข 1,2 และ 3 ตามลำดับ
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user\_guide/indexing.html#returning-a-view-versus-a-copy
    """Entry point for launching an IPython kernel.
      dcode      dname population59  garbage59  movein59  moveout59  num_park59  AmountOfGarbage
0  1001   พะนังคร  52522  70243.12   2815   3644    111      2
1  1002     คุลีต  98450  63750.08   9438  13091    115      2
2  1003  หนองจอก  167844  43545.74  10747   7536    178      1
3  1004     บางรัก  47308  58286.80   1656   5967    243      2
4  1005     บางเขน  190828 102066.16  14337  13537     72      3
5  1006     บางกะปิ  148392 106544.60   9016   9826    157      3
6  1007     ปทุมธานี  49594  30383.52   2016   8863    122      1
7  1008  มีอมปารานีคุรุพยา  47450  117706.24   1200   3340    112      3
8  1009     พระโขนง  91305  53592.83   5586   5796    332      2
9  1010     มีนบุรี  141214  69050.94   8763  12231    226      2
10 1011  ลาดกระบัง  171933  95759.88  11843   9343    114      2
11 1012     ยานนาวา  79574  67770.90   4083   4188    215      2
12 1013  สัมพันธวงศ์  24785  20401.97   673   1268     97      1
13 1014     พญาไท  72102  60367.09   6717   8460     71      2
14 1015     ชนบุรี  111027  57750.21   4521   7901    126      2
15 1016     บางกอกใหญ่  67887  29004.66   2486   3366    100      1
16 1017     ทวีวิวัฒ  81190  71851.82   6049   6943    107      2
17 1018     คลองสาน  73871  46209.77   2959   5304    131      1
```

```
[62] 1 X1 = data59_2[['num_park59','population59', 'movein59', 'moveout59']]
2 X1
3 #กำหนดค่าX คือ จำนวนสวนสาธารณะปี59 จำนวนประชากรปี59 และการย้ายเข้า-ออกปี59
```

| | num_park59 | population59 | movein59 | moveout59 |
|----|------------|--------------|----------|-----------|
| 0 | 111 | 52522 | 2815 | 3644 |
| 1 | 115 | 98450 | 9438 | 13091 |
| 2 | 178 | 167844 | 10747 | 7536 |
| 3 | 243 | 47308 | 1656 | 5967 |
| 4 | 72 | 190828 | 14337 | 13537 |
| 5 | 157 | 148392 | 9016 | 9826 |
| 6 | 122 | 49594 | 2016 | 8863 |
| 7 | 112 | 47450 | 1200 | 3340 |
| 8 | 332 | 91305 | 5586 | 5796 |
| 9 | 226 | 141214 | 8763 | 12231 |
| 10 | 114 | 171933 | 11843 | 9343 |
| 11 | 215 | 79574 | 4083 | 4188 |
| 12 | 97 | 24785 | 673 | 1268 |
| 13 | 71 | 72102 | 6717 | 8460 |
| 14 | 126 | 111027 | 4521 | 7901 |
| 15 | 100 | 67887 | 2486 | 3366 |



```
[63] 1 X1.dtypes
num_park59    int64
population59   int64
movein59      int64
moveout59     int64
dtype: object

[64] 1 X = X1.replace('^\d.', '', regex=True).astype(float)
2 #แทนค่าในตารางจาก int ให้เป็น float ทั้งหมด
```

```
1 y1 = data59_2[['AmountOfGarbage']]
2 y1 #ค่า y เป็นส่วนของตัวตั้งนี้
```

| | AmountOfGarbage |
|----|-----------------|
| 0 | 2 |
| 1 | 2 |
| 2 | 1 |
| 3 | 2 |
| 4 | 3 |
| 5 | 3 |
| 6 | 1 |
| 7 | 3 |
| 8 | 2 |
| 9 | 2 |
| 10 | 2 |
| 11 | 2 |
| 12 | 1 |
| 13 | 2 |
| 14 | 2 |
| 15 | 1 |
| 16 | 2 |
| 17 | 1 |
| 18 | 1 |
| 19 | 2 |
| 20 | 3 |
| 21 | 2 |
| 22 | 2 |
| 23 | 1 |
| 24 | 2 |
| 25 | 2 |
| 26 | 2 |
| 27 | 2 |
| 28 | 2 |
| 29 | 3 |
| 30 | 2 |

```
[67] 1 y1.shape
(50, 1)

1 y2 = data59_2['AmountOfGarbage']
2 y2
```

| | y2 |
|----|----|
| 0 | 2 |
| 1 | 2 |
| 2 | 1 |
| 3 | 2 |
| 4 | 3 |
| 5 | 3 |
| 6 | 1 |
| 7 | 3 |
| 8 | 2 |
| 9 | 2 |
| 10 | 2 |
| 11 | 2 |
| 12 | 1 |
| 13 | 2 |
| 14 | 2 |
| 15 | 1 |
| 16 | 2 |
| 17 | 1 |
| 18 | 1 |
| 19 | 2 |
| 20 | 3 |
| 21 | 2 |
| 22 | 2 |
| 23 | 1 |
| 24 | 2 |
| 25 | 2 |
| 26 | 2 |
| 27 | 2 |
| 28 | 2 |
| 29 | 3 |
| 30 | 2 |

```
[69] 1 y = y2.values
2 y
[2, 2, 1, 2, 3, ..., 2, 2, 1, 1, 2]
Length: 50
Categories (3, int64): [1 < 2 < 3]
```

```
[70] 1 y.shape #ต้องทำให้ shape เป็น (n_sample, ) ถึงจะนำข้อมูลไปวิเคราะห์ได้
(50,)
```



Classification



Classification

Decision Tree

```
[71] 1 from sklearn.model_selection import train_test_split  
2 #import ชึ้นชื่อมุม
```

Train - Test

```
[72] 1 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.5, random_state=6) #การ Train-Test เป็นการแบ่งข้อมูลที่ได้มา มา train model เพื่อที่จะได้รับผลลัพธ์ที่จะนำไปใช้เครื่องห่อไป
```

```
[73] 1 X_train.shape #ขนาดข้อมูล  
0s  
(25, 4)
```

Train - Validation

```
[74] 1 X_train2, X_val, y_train2, y_val = train_test_split(X_train, y_train, test_size=0.3, random_state=6) #การ Train-Validation เป็นการแบ่งข้อมูลไว้เพื่อทดสอบเพื่อหาค่าที่ดีที่สุด validation set จะหาหน้าที่ เสมือนเป็นข้อมูลที่ไม่เคยเห็นมาก่อน แล้วใช้ทดสอบ
```

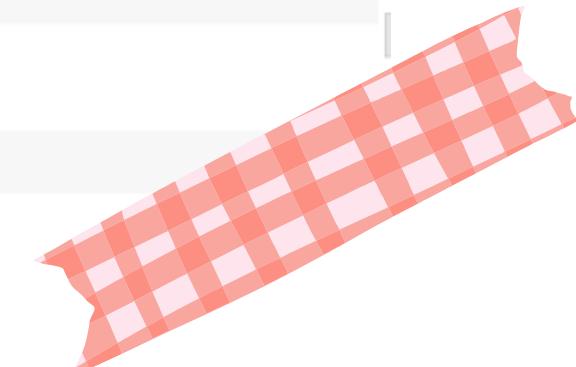
```
[75] 1 X_train2.shape  
0s  
(17, 4)
```

import

```
[76] 1 from sklearn.tree import DecisionTreeClassifier
```

define

```
[77] 1 mytree = DecisionTreeClassifier(random_state=6) #มุ่ง กำหนดrandom เผาที่ 6
```





Classification

train

```
[78] 1 mytree.fit(X_train2,y_train2) #สร้างโมเดลของข้อมูล  
  
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='gini',  
max_depth=None, max_features=None, max_leaf_nodes=None,  
min_impurity_decrease=0.0, min_impurity_split=None,  
min_samples_leaf=1, min_samples_split=2,  
min_weight_fraction_leaf=0.0, presort='deprecated',  
random_state=6, splitter='best')
```

Evaluate

```
[79] 1 from sklearn.metrics import accuracy_score
```

Test

```
[80] 1 mytree_result = mytree.predict(X_val)
```

```
[81] 1 DecisionTree = accuracy_score(y_val,mytree_result)  
2 DecisionTree  
3  
4 #ค่าความแม่นยำ เท่ากับ 75%
```

0.75

plot tree

```
[82] 1 from sklearn.tree import plot_tree #import ชื่อมุก  
  
1 plot_tree(mytree) # plot แผนภูมิพื้นที่
```

[Text(148.8, 195.696, 'X[3] <= 3777.0\ngini = 0.381\nsamples = 17\nvalue = [1, 13, 3]'),
Text(111.6000000000001, 152.208, 'gini = 0.0\nsamples = 1\nvalue = [1, 0, 0]'),
Text(186.0, 152.208, 'X[1] <= 175850.5\ngini = 0.305\nsamples = 16\nvalue = [0, 13, 3]'),
Text(111.6000000000001, 108.72, 'X[3] <= 6669.0\ngini = 0.142\nsamples = 13\nvalue = [0, 12, 1]'),
Text(74.4, 65.232, 'X[3] <= 6273.5\ngini = 0.375\nsamples = 4\nvalue = [0, 3, 1]'),
Text(37.2, 21.744, 'gini = 0.0\nsamples = 3\nvalue = [0, 3, 0]'),
Text(111.6000000000001, 21.744, 'gini = 0.0\nsamples = 1\nvalue = [0, 0, 1]'),
Text(148.8, 65.232, 'gini = 0.0\nsamples = 9\nvalue = [0, 9, 0]'),
Text(260.4000000000003, 108.72, 'X[2] <= 15039.5\ngini = 0.444\nsamples = 3\nvalue = [0, 1, 2]'),
Text(223.2000000000002, 65.232, 'gini = 0.0\nsamples = 2\nvalue = [0, 0, 2]'),
Text(297.6, 65.232, 'gini = 0.0\nsamples = 1\nvalue = [0, 1, 0]'))



root node คือ $X[3] \leq 3777.0$

information gain = 0.381 ค่ามากสุดเป็น root node

มี data ในล็อกเกอร์ 17 ตัว

แบ่งเป็น 3 กลุ่ม คือ 1, 13, 3



Classification

KNN

```
[84] 1 from sklearn.neighbors import KNeighborsClassifier #import ฟังก์ชัน
```

KNN1

```
[85] 1 # Define  
2 neigh1 = KNeighborsClassifier(n_neighbors=3, weights='uniform') #กำหนดเพื่อแบ่งทีโกลสุด 3 คน และใช้อุปกรณ์เดิม  
3 # Train  
4 neigh1.fit(X_train2,y_train2)  
5 # Test  
6 knn1_result = neigh1.predict(X_val)  
7 accuracy_score(y_val, knn1_result)  
8
```

0.625

KNN2

```
[86] 1 # Define  
2 neigh2 = KNeighborsClassifier(n_neighbors=7, weights='distance') #กำหนดเพื่อแบ่งทีโกลสุด 7 คน และใช้อุปกรณ์อยู่ใกล้มากกว่าคนที่อยู่ไกล  
3 # Train  
4 neigh2.fit(X_train2,y_train2)  
5 # Test  
6 knn2_result = neigh2.predict(X_val)  
7 accuracy_score(y_val, knn2_result)  
8
```

0.625

KNN3

```
[87] 1 # Define  
2 neigh3 = KNeighborsClassifier(n_neighbors=1) #กำหนดเพื่อแบ่งทีโกลที่สุดคนเดียว  
3 # Train  
4 neigh3.fit(X_train2,y_train2)  
5 # Test  
6 knn3_result = neigh3.predict(X_val)  
7 accuracy_score(y_val, knn3_result)
```

0.75

Classification

Neural Network

```
[88] 1 from sklearn.neural_network import MLPClassifier  
[89] 1 perceptron1 = MLPClassifier(random_state=6, max_iter=2000, hidden_layer_sizes=1, learning_rate_init=0.005)
```

Train - Test

ANN1

```
[90] 1 # Train  
2 perceptron1.fit(X_train2,y_train2)  
3 # Test  
4 ann1_result = perceptron1.predict(X_val)  
5 accuracy_score(y_val, ann1_result)
```

0.625

ANN 2

```
[91] 1 perceptron2 = MLPClassifier(random_state=6, max_iter=2000, hidden_layer_sizes=10, learning_rate_init=0.005)  
2 # Train  
3 perceptron2.fit(X_train2,y_train2)  
4 # Test  
5 ann2_result = perceptron2.predict(X_val)  
6 accuracy_score(y_val, ann2_result)
```

0.75

ANN 3

```
[92] 1 perceptron3 = MLPClassifier(random_state=6, max_iter=20000, hidden_layer_sizes=10, learning_rate_init=0.001)  
2 # Train  
3 perceptron3.fit(X_train2,y_train2)  
4 # Test  
5 ann3_result = perceptron3.predict(X_val)  
6 accuracy_score(y_val, ann3_result)  
7
```

0.625

Retrain & Evaluate

KNN

```
[93] 1 # Define  
2 neigh3_final = KNeighborsClassifier(n_neighbors=1)  
3 # Train  
4 neigh3_final.fit(X_train,y_train)  
5 # Test  
6 knn3final_result = neigh3_final.predict(X_test)
```

```
[95] 1 KNN = accuracy_score(y_test, knn3final_result)  
2 KNN
```

0.36

Neural Network

```
[96] 1 perceptron2_final = MLPClassifier(random_state=6, max_iter=2000, hidden_layer_sizes=10, learning_rate_init=0.005)  
2 #Train  
3 perceptron2_final.fit(X_train,y_train)  
4 #Test  
5 perceptron2final_result = perceptron2_final.predict(X_test)
```

```
[97] 1 Neural = accuracy_score(y_test,perceptron2final_result)  
2 Neural
```

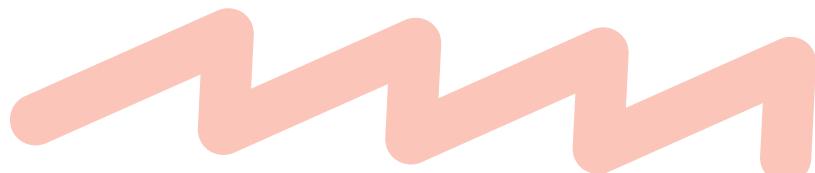
0.6

DecisionTree

```
[98] 1 DecisionTree = accuracy_score(y_val,mytree_result)  
2 DecisionTree
```

0.75

จาก Model ทั้ง 3 ชนิด พบว่า Model ที่มีความแม่นยำมากที่สุด คือ DesisionTree มีความแม่นยำ 75%



เลือกโมเดลทำนาย



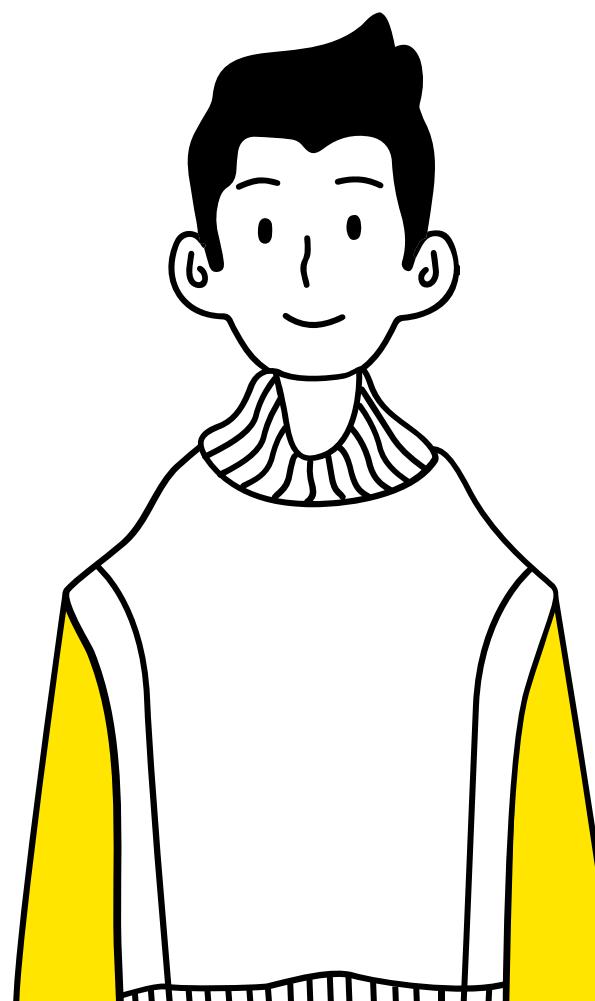
```
[105]: 1 ret = classification_report(y_val, mytree_result)
      2 print(ret)
      3
      4 #1 precision 100% recall 50% f1-score 67% support(จำนวนข้อมูลที่เป็น1) 2 ตัว
      5 #2 precision 71% recall 100% f1-score 83% support(จำนวนข้อมูลที่เป็น2) 5 ตัว
      6 #3 precision 0% recall 0% f1-score 0% support(จำนวนข้อมูลที่เป็น3) 1 ตัว
      7 #ความแม่นยำ 75%
```

| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| 1 | 1.00 | 0.50 | 0.67 | 2 |
| 2 | 0.71 | 1.00 | 0.83 | 5 |
| 3 | 0.00 | 0.00 | 0.00 | 1 |
| accuracy | | | 0.75 | 8 |
| macro avg | 0.57 | 0.50 | 0.50 | 8 |
| weighted avg | 0.70 | 0.75 | 0.69 | 8 |

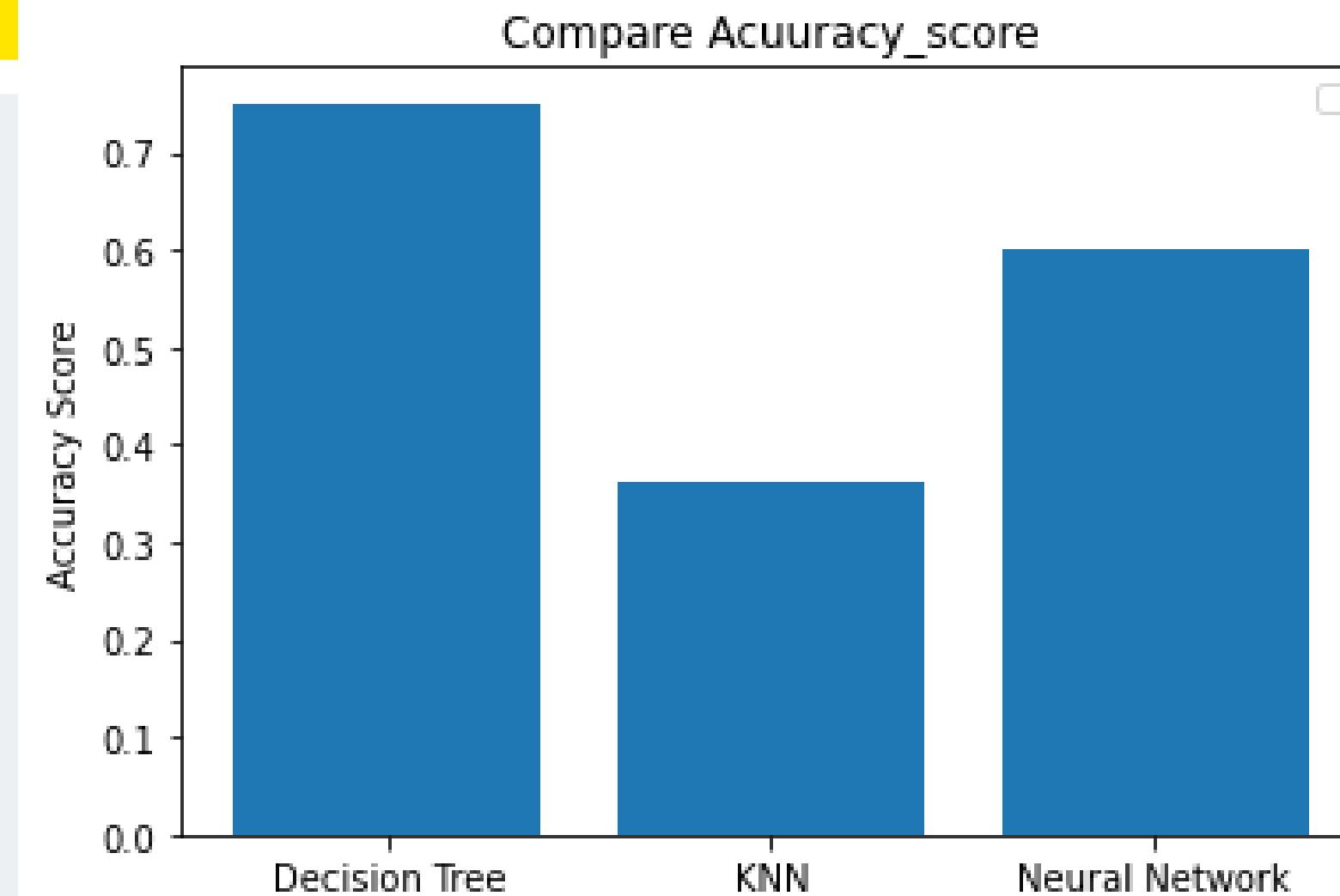
```
/usr/local/lib/python3.7/dist-packages/sklearn/metrics/_classification.py:1272:
    _warn_prf(average, modifier, msg_start, len(result))
```

Visualization

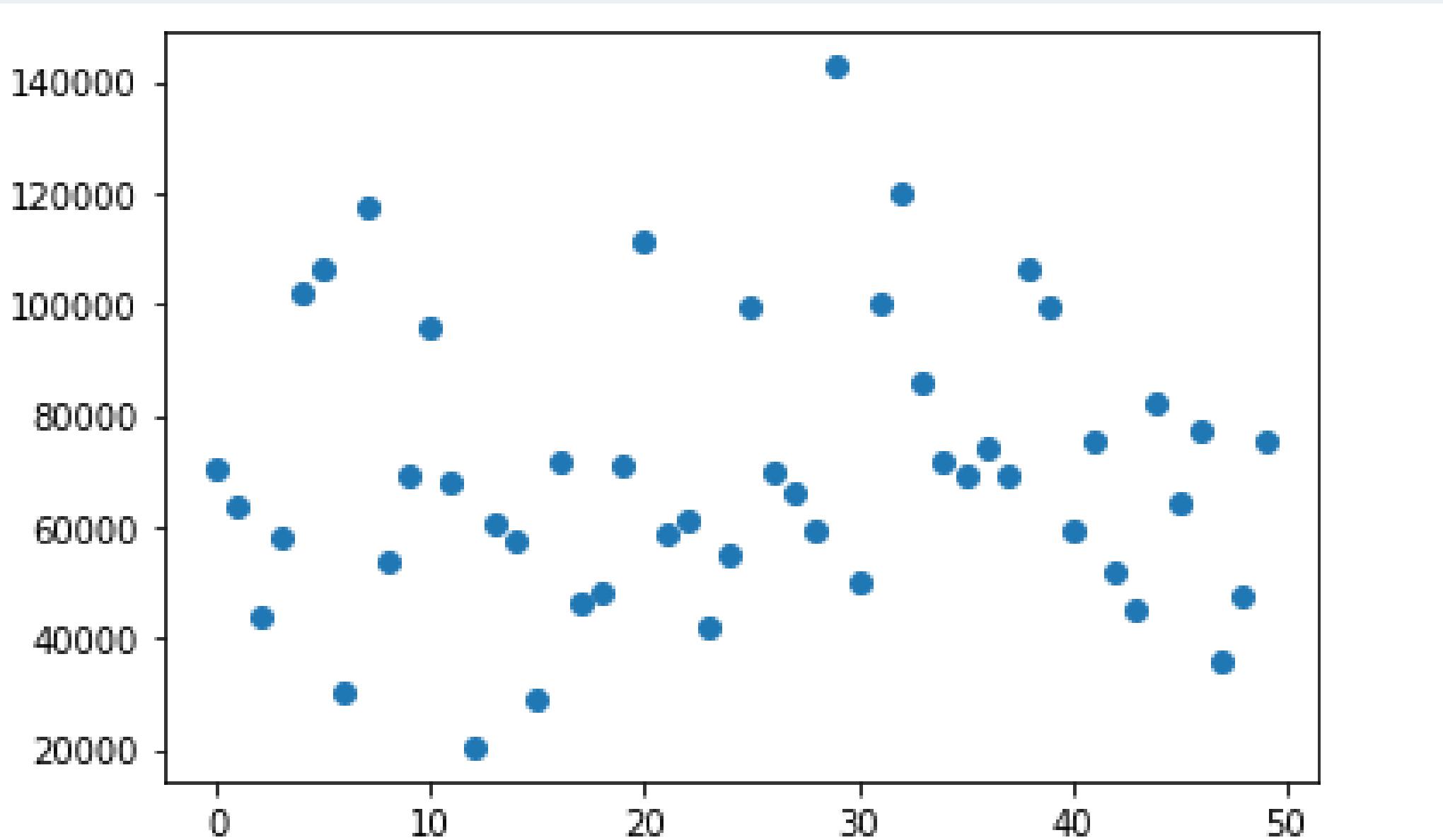
จะเห็นได้จากการเปรียบเทียบความแม่นยำพว่า accuracy_score ของ Dicision Tree มีความแม่นยามากที่สุด



เปรียบเทียบความแม่นยำ ของการทำ Classification ด้วย accuracy_score



Visualization



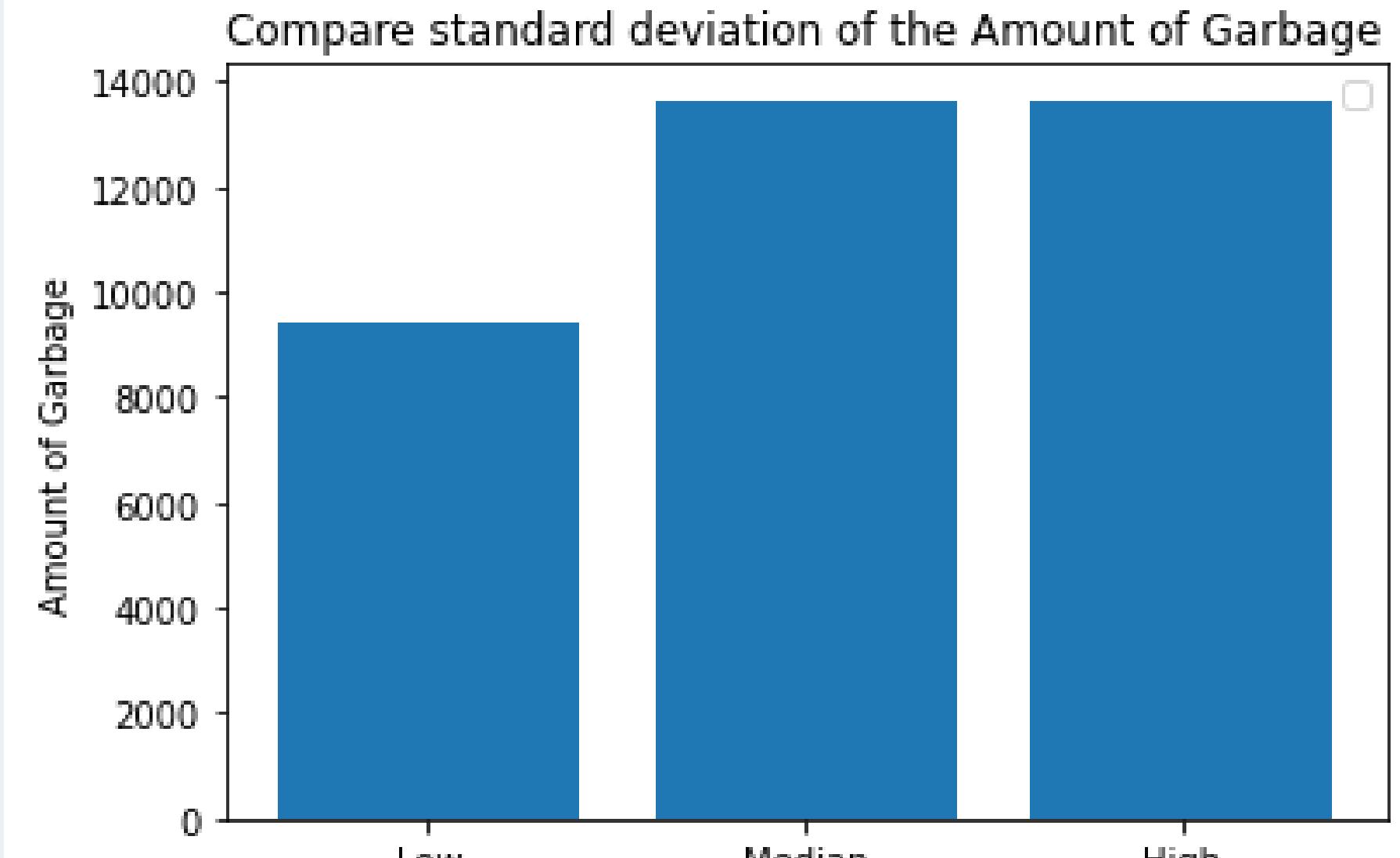
กราฟการกระจายของปริมาณขยะ
ในเขตกรุงเทพมหานคร

Visualization

จากแท่งกราฟ จะเห็นได้ว่าค่าการกระจายของปริมาณขยะปานกลางและปริมาณขยะมาก มีค่าการกระจายที่ใกล้เคียงกัน และ มีค่าการกระจายมากกว่าปริมาณขยะน้อย



เปรียบเทียบค่าการกระจายของปริมาณขยะ
ในเขตพื้นที่กรุงเทพมหานคร



จบการนำเสนอ

