**第一次：**

**D:\Anaconda\python.exe D:\python\Q4.py**

**归一化随机坐标：[0.545 0.436 0.83075621]，相应的原坐标：[4037.36 4037.36 -49.99]**

**归一化随机坐标：[0.05 0.788 0.78538375]，相应的原坐标：[ 370.4 7296.88 -58.03]**

**归一化随机坐标：[0.61 0.208 0.75959368]，相应的原坐标：[4518.88 1926.08 -62.6 ]**

**归一化随机坐标：[0.795 0.144 0.50886005]，相应的原坐标：[5889.36 1333.44 -107.03]**

**归一化随机坐标：[0.78 0.164 0.54198646]，相应的原坐标：[5778.24 1518.64 -101.16]**

**聚类中心坐标：[[5638.10193996 7061.82556956 -72.06801353]**

**[1856.46764018 7117.67554803 -58.41111384]**

**[1413.96854727 2389.03017679 -26.81404785]**

**[6409.26103034 2141.40812822 -116.75730967]**

**[4114.81227504 2782.42561969 -55.00346138]]**

**法向量分别为：[[ -8.5192 0. -1371.9616]**

**[ -3.3336 -30.7432 -2743.9232]**

**[ 4.0744 3.704 1371.9616]**

**[ 93.7112 -35.188 2743.9232]**

**[ -48.8928 4.4448 -2743.9232]]**

**坡角（弧度制）分别为：[0.00620942 0.0112693 0.0040135 0.0364644 0.01789014]**

**坡角（角度制）分别为：[0.35577376 0.64568346 0.22995638 2.08925599 1.02502978]**

**[2952.5194959759588, 2834.788555883883, 3034.9543333742167, 3168.6656354802276, 2983.784196769268]**

**每一块近似长度分别为：[4175.49311438 4008.99642219 4292.07357944 4481.16991632 4219.70807827]**

**第1块共18条测线，测线距离为：[257.30540927475744, 252.4181080228047, 247.62363697444025, 242.9202328975133, 238.3061660509943, 233.77973954883942, 229.33928873593723, 224.98318057590933, 220.70981305053868, 216.51761457060584, 212.4050433979152, 208.37058707830008, 204.4127618853969, 200.53011227498462, 196.72121034968842, 192.984655333851, 189.31907305837836]，测线坐标为：[-1940.4670163653766, -1683.161607090619, -1430.7434990678144, -1183.1198620933742, -940.1996291958609, -701.8934631448666, -468.11372359602717, -238.77443486008994, -13.79125428418061, 206.91855876635807, 423.4361733369639, 635.8412167348791, 844.2118038131792, 1048.6245656985761, 1249.1546779735609, 1445.8758883232492, 1638.8605436571002, 1828.1796167154785]**

**第2块共23条测线，测线距离为：[239.3059726617269, 231.1797010986798, 223.32937872646104, 215.7456349554554, 208.41941739937155, 201.34198106980085, 194.50487793770353, 187.89994684936255, 181.51930378476825, 175.35533244680514, 169.4006751700081, 163.64822413803608, 158.0911128993797, 152.72270817117558, 147.5366019213442, 142.52660371959945, 137.68673334820065, 133.0112136636254, 128.4944637006439, 124.13109201056268, 119.91589022568573, 115.84382684231197]，测线坐标为：[-1864.1997288273637, -1624.893756165637, -1393.7140550669571, -1170.384676340496, -954.6390413850406, -746.219623985669, -544.8776429158681, -350.3727649781646, -162.47281812880203, 19.046485655966222, 194.40181810277136, 363.80249327277943, 527.4507174108155, 685.5418303101952, 838.2645384813708, 985.801140402715, 1128.3277441223145, 1266.0144774705152, 1399.0256911341405, 1527.5201548347845, 1651.6512468453473, 1771.567137071033, 1887.4109639133449]**

**第3块共53条测线，测线距离为：[108.33381413477578, 106.99492092500581, 105.67257504204686, 104.36657197815875, 103.07670975310425, 101.80278888291163, 100.54461234902351, 99.30198556782679, 98.07471636055944, 96.86261492358884, 95.66549379905786, 94.48316784589332, 93.31545421117313, 92.162172301847, 91.02314375680677, 89.89819241930208, 88.78714430969657, 87.68982759856127, 86.60607258010002, 85.53571164590379, 84.47857925902903, 83.4345119283966, 82.40334818350692, 81.38492854946774, 80.37909552233059, 79.38569354473188, 78.40456898183513, 77.4355700975706, 76.47854703116846, 75.53335177398208, 74.5998381465976, 73.6778617762267, 72.76728007437843, 71.86795221480723, 70.97973911173337, 70.10250339833263, 69.23610940549183, 68.3804231408268, 67.53531226795982, 66.70064608605313, 65.87629550959522, 65.06213304843729, 64.25803278807602, 63.4638703701804, 62.67952297335891, 61.90486929416466, 61.13978952833515, 60.38416535226384, 59.63787990470091, 58.90081776867991, 58.17286495366804, 57.45390887793686]，测线坐标为：[-2084.6750723929945, -1976.3412582582187, -1869.346337333213, -1763.673762291166, -1659.3071903130071, -1556.2304805599028, -1454.4276916769911, -1353.8830793279676, -1254.581093760141, -1156.5063773995814, -1059.6437624759926, -963.9782686769347, -869.4951008310413, -776.1796466198682, -684.0174743180212, -592.9943305612144, -503.0961381419123, -414.3089938322157, -326.6191662336545, -240.01309365355445, -154.47738200765065, -69.99880274862161, 13.435709179774989, 95.83905736328191, 177.22398591274964, 257.60308143508024, 336.9887749798121, 415.39334396164725, 492.8289140592178, 569.3074610903863, 644.8408128643683, 719.4406510109659, 793.1185127871926, 865.885792861571, 937.7537450763782, 1008.7334841881116, 1078.8359875864442, 1148.072096991936, 1216.4525201327629, 1283.9878324007227, 1350.688478486776, 1416.564773996371, 1481.6269070448084, 1545.8849398328844, 1609.3488102030647, 1672.0283331764235, 1733.9332024705882, 1795.0729919989233, 1855.457157351187, 1915.095037255888, 1973.9958550245678, 2032.168719978236, 2089.622628856173]**

**第4块共15条测线，测线距离为：[522.7248564830661, 469.1199228057403, 421.0121237660966, 377.8377334689272, 339.0908355699766, 304.3173949618266, 273.1099374027201, 245.10277474435574, 219.96771980800148, 197.41024069596216, 177.16600947472347, 158.997804787337, 142.69273209993992, 128.0597290093331]，测线坐标为：[-1896.7813295801827, -1374.0564730971166, -904.9365502913763, -483.9244265252797, -106.08669305635254, 233.00414251362406, 537.3215374754507, 810.4314748781708, 1055.5342496225264, 1275.5019694305279, 1472.91221012649, 1650.0782196012135, 1809.0760243885504, 1951.7687564884905, 2079.8284854978237]**

**第5块共30条测线，测线距离为：[265.6908583719854, 251.63825541787082, 238.3289059237963, 225.72349861713388, 213.78480143004745, 202.4775515286807, 191.76835115879004, 181.62556900018552, 172.01924673861438, 162.9210105791331, 154.30398743960814, 146.14272557680957, 138.41311941065487, 131.0923383245584, 124.15875923158751, 117.59190270724963, 111.37237250026648, 105.48179824267278, 99.9027811900236, 94.61884283144583, 89.61437621774515, 84.87459986380868, 80.38551408914654, 76.13385966761727, 72.1070786642024, 68.2932773431556, 64.68119103796947, 61.26015087939825, 58.0200522832619]，测线坐标为：[-1949.200987362206, -1683.5101289902204, -1431.8718735723496, -1193.5429676485533, -967.8194690314194, -754.034667601372, -551.5571160726913, -359.7887649139013, -178.16319591371575, -6.143949175101369, 156.77706140403174, 311.0810488436399, 457.22377442044944, 595.6368938311043, 726.7292321556627, 850.8879913872502, 968.4798940944997, 1079.8522665947662, 1185.334064837439, 1285.2368460274627, 1379.8556888589085, 1469.4700650766536, 1554.3446649404623, 1634.7301790296087, 1710.864038697226, 1782.9711173614285, 1851.264394704584, 1915.9455857425535, 1977.2057366219517, 2035.2257889052137]**

**测线总长度为588654.4845723937米**

**超过20%的测线长度：59799.56810747057**

**第二次：**

**D:\Anaconda\python.exe D:\python\Q4.py**

**归一化随机坐标：[0.75 0.58 0.71540632]，相应的原坐标：[5556. 5370.8 -70.43]**

**归一化随机坐标：[0.145 0.944 0.67844244]，相应的原坐标：[1074.16 8741.44 -76.98]**

**归一化随机坐标：[0.33 0.9 0.71106095]，相应的原坐标：[2444.64 8334. -71.2 ]**

**归一化随机坐标：[0.86 0.356 0.54582393]，相应的原坐标：[6370.88 3296.56 -100.48]**

**归一化随机坐标：[0.425 0.756 0.78702032]，相应的原坐标：[3148.4 7000.56 -57.74]**

**聚类中心坐标：[[5637.72983762 7062.07822733 -72.06211604]**

**[1856.05453529 7118.11327967 -58.41367957]**

**[4113.76187527 2783.20948664 -54.98781396]**

**[6409.17020595 2142.46098398 -116.74161184]**

**[1413.44768166 2388.58513649 -26.8106113 ]]**

**法向量分别为：[[ -8.5192 0. -1371.9616]**

**[ -3.3336 -30.7432 -2743.9232]**

**[ -48.8928 4.4448 -2743.9232]**

**[ 93.7112 -35.188 2743.9232]**

**[ 4.0744 3.704 1371.9616]]**

**坡角（弧度制）分别为：[0.00620942 0.0112693 0.01789014 0.0364644 0.0040135 ]**

**坡角（角度制）分别为：[0.35577376 0.64568346 1.02502978 2.08925599 0.22995638]**

**[2952.0829716701483, 2834.187213411941, 2984.136101834613, 3167.695100793162, 3035.1055280902037]**

**每一块近似长度分别为：[4174.87577579 4008.14599551 4220.20574718 4479.797373 4292.28740106]**

**第1块共18条测线，测线距离为：[257.28176366878506, 252.3949115453602, 247.60088109470246, 242.8979092466969, 238.28426641927214, 233.75825588232308, 229.3182131337153, 224.9625052871414, 220.68953047160522, 216.49771724231164, 212.38552400274628, 208.35143843773253, 204.39397695725688, 200.51168415085843, 196.703132252382, 192.96692061489742, 189.30167519559265]，测线坐标为：[-1940.1718816227167, -1682.8901179539316, -1430.4952064085714, -1182.894325313869, -939.9964160671722, -701.7121496479, -467.95389376557694, -238.63568063186165, -13.67317534472025, 207.01635512688497, 423.5140723691966, 635.8995963719428, 844.2510348096754, 1048.6450117669324, 1249.1566959177908, 1445.8598281701727, 1638.82674878507, 1828.1284239806628]**

**第2块共23条测线，测线距离为：[239.299395321079, 231.17334710914875, 223.3232405035649, 215.73970517226348, 208.4136889777587, 201.33644717199843, 194.49953195813745, 187.8947824067688, 181.51431471457548, 175.3505127937764, 169.3960191811325, 163.64372625566145, 158.08676775457872, 152.71851057733727, 147.53254686798263, 142.52268636637325, 137.68294901913498, 133.00755784153066, 128.4909320217237, 124.12768025920491, 119.91259432943069, 115.84064286699106]，测线坐标为：[-1863.7783716007973, -1624.4789762797184, -1393.3056291705695, -1169.9823886670047, -954.2426834947412, -745.8289945169824, -544.492547344984, -349.99301538684654, -162.09823298007774, 19.416081734497737, 194.76659452827414, 364.1626137094066, 527.8063399650681, 685.8931077196469, 838.6116182969841, 986.1441651649668, 1128.66685153134, 1266.3498005504748, 1399.3573583920054, 1527.848290413729, 1651.975970672934, 1771.8885650023647, 1887.7292078693558]**

**第3块共30条测线，测线距离为：[265.65878959916193, 251.60788278820593, 238.30013972691563, 225.69625388751686, 213.75899769606812, 202.45311257492213, 191.7452048009299, 181.60364687178833, 171.99848408920025, 162.90134608292712, 154.28536301440482, 146.12508621241804, 138.39641300641742, 131.07651553546287, 124.14377332251924, 117.57770941495158, 111.35892990260088, 105.46906663479743, 99.8907229671173, 94.60742237763658, 89.603559800913, 84.86435553595265, 80.37581159202107, 76.1246703433597, 72.09837537068748, 68.28503437382683, 64.67338404591088, 61.252756805421754, 58.01304928779836]，测线坐标为：[-1949.4692125747947, -1683.8104229756327, -1432.2025401874268, -1193.9024004605112, -968.2061465729944, -754.4471488769262, -551.9940363020041, -360.2488315010742, -178.6451846292859, -6.6467005400856465, 156.25464554284147, 310.5400085572463, 456.6650947696644, 595.0615077760818, 726.1380233115447, 850.2817966340639, 967.8595060490154, 1079.2184359516164, 1184.6875025864138, 1284.578225553531, 1379.1856479311675, 1468.7892077320805, 1553.6535632680332, 1634.0293748600543, 1710.154045203414, 1782.2524205741015, 1850.5374549479284, 1915.2108389938392, 1976.463595799261, 2034.4766450870593]**

**第4块共15条测线，测线距离为：[522.6175875169178, 469.0236541693919, 420.9257273862568, 377.760196955141, 339.02125035146076, 304.2549456408622, 273.0538921998438, 245.0524769233876, 219.92257998042828, 197.3697299144985, 177.12965303512178, 158.96517666581593, 142.66344996104903, 128.0334497257564]，测线坐标为：[-1896.1656102577463, -1373.5480227408284, -904.5243685714365, -483.5986411851797, -105.8384442300387, 233.18280612142206, 537.4377517622843, 810.4916439621281, 1055.5441208855157, 1275.466700865944, 1472.8364307804425, 1649.9660838155642, 1808.9312604813801, 1951.5947104424292, 2079.628160168186]**

**第5块共53条测线，测线距离为：[108.3246175527905, 106.98583800320384, 105.6636043757066, 104.35771217991955, 103.0679594527517, 101.79414672716582, 100.53607700132962, 99.29355570814846, 98.06639068517455, 96.85439214488795, 95.65737264534503, 94.47514706118946, 93.30753255502172, 92.15434854912229, 91.0154166975243, 89.89056085843148, 88.7796070669769, 87.6823835083183, 86.59872049106608, 85.52845042103966, 84.47140777534817, 83.42742907679133, 82.396352868577, 81.37801968935099, 80.37227204853548, 79.37895440197232, 78.39791312786728, 77.42899650303167, 76.4720546794175, 75.52693966094276, 74.59350528060297, 73.67160717786574, 72.76110277634463, 71.86185126174898, 70.97371356010622, 70.09655231625337, 69.23023187259433, 68.3746182481197, 67.52957911768597, 66.6949837915507, 65.87070319516064, 65.05660984918971, 64.25257784982367, 63.458482849288394, 62.67420203661883, 61.89961411866569, 61.13459930133676, 60.37903927107018, 59.632817176536555, 58.895817610567356, 58.167926592306564, 57.449031549582905]，测线坐标为：[-2084.787192268653, -1976.4625747158627, -1869.476736712659, -1763.8131323369523, -1659.4554201570327, -1556.387460704281, -1454.5933139771153, -1354.0572369757856, -1254.7636812676371, -1156.6972905824625, -1059.8428984375746, -964.1855257922296, -869.7103787310401, -776.4028461760184, -684.2484976268961, -593.2330809293718, -503.3425200709403, -414.5629130039634, -326.8805294956451, -240.281809004579, -154.75335858353935, -70.28195080819118, 13.145478268600144, 95.54183113717714, 176.91985082652815, 257.2921228750636, 336.6710772770359, 415.0689904049032, 492.4979869079349, 568.9700415873524, 644.4969812482951, 719.090486528898, 792.7620937067638, 865.5231964831084, 937.3850477448574, 1008.3587613049637, 1078.455313621217, 1147.6855454938113, 1216.060163741931, 1283.589742859617, 1350.2847266511676, 1416.1554298463282, 1481.212039695518, 1545.4646175453415, 1608.92310039463, 1671.5973024312489, 1733.4969165499147, 1794.6315158512514, 1855.0105551223216, 1914.6433722988581, 1973.5391899094254, 2031.707116501732, 2089.1561480513146]**

**测线总长度为588629.4871275553米**

**超过20%的测线长度：59803.69699931396**

**第三次：**

**D:\Anaconda\python.exe D:\python\Q4.py**

**归一化随机坐标：[0.69 0.324 0.71168172]，相应的原坐标：[5111.52 3000.24 -71.09]**

**归一化随机坐标：[0.69 0.536 0.74633183]，相应的原坐标：[5111.52 4963.36 -64.95]**

**归一化随机坐标：[0.675 0.312 0.72274266]，相应的原坐标：[5000.4 2889.12 -69.13]**

**归一化随机坐标：[0.745 0.024 0.51089165]，相应的原坐标：[5518.96 222.24 -106.67]**

**归一化随机坐标：[0.29 0.94 0.68301354]，相应的原坐标：[2148.32 8704.4 -76.17]**

**聚类中心坐标：[[4114.81227504 2782.42561969 -55.00346138]**

**[5638.10193996 7061.82556956 -72.06801353]**

**[1413.96854727 2389.03017679 -26.81404785]**

**[6409.26103034 2141.40812822 -116.75730967]**

**[1856.46764018 7117.67554803 -58.41111384]]**

**法向量分别为：[[ -48.8928 4.4448 -2743.9232]**

**[ -8.5192 0. -1371.9616]**

**[ 4.0744 3.704 1371.9616]**

**[ 93.7112 -35.188 2743.9232]**

**[ -3.3336 -30.7432 -2743.9232]]**

**坡角（弧度制）分别为：[0.01789014 0.00620942 0.0040135 0.0364644 0.0112693 ]**

**坡角（角度制）分别为：[1.02502978 0.35577376 0.22995638 2.08925599 0.64568346]**

**[2983.784196769268, 2952.5194959759588, 3034.9543333742167, 3168.6656354802276, 2834.788555883883]**

**每一块近似长度分别为：[4219.70807827 4175.49311438 4292.07357944 4481.16991632 4008.99642219]**

**第1块共30条测线，测线距离为：[265.6908583719854, 251.63825541787082, 238.3289059237963, 225.72349861713388, 213.78480143004745, 202.4775515286807, 191.76835115879004, 181.62556900018552, 172.01924673861438, 162.9210105791331, 154.30398743960814, 146.14272557680957, 138.41311941065487, 131.0923383245584, 124.15875923158751, 117.59190270724963, 111.37237250026648, 105.48179824267278, 99.9027811900236, 94.61884283144583, 89.61437621774515, 84.87459986380868, 80.38551408914654, 76.13385966761727, 72.1070786642024, 68.2932773431556, 64.68119103796947, 61.26015087939825, 58.0200522832619]，测线坐标为：[-1949.200987362206, -1683.5101289902204, -1431.8718735723496, -1193.5429676485533, -967.8194690314194, -754.034667601372, -551.5571160726913, -359.7887649139013, -178.16319591371575, -6.143949175101369, 156.77706140403174, 311.0810488436399, 457.22377442044944, 595.6368938311043, 726.7292321556627, 850.8879913872502, 968.4798940944997, 1079.8522665947662, 1185.334064837439, 1285.2368460274627, 1379.8556888589085, 1469.4700650766536, 1554.3446649404623, 1634.7301790296087, 1710.864038697226, 1782.9711173614285, 1851.264394704584, 1915.9455857425535, 1977.2057366219517, 2035.2257889052137]**

**第2块共18条测线，测线距离为：[257.30540927475744, 252.4181080228047, 247.62363697444025, 242.9202328975133, 238.3061660509943, 233.77973954883942, 229.33928873593723, 224.98318057590933, 220.70981305053868, 216.51761457060584, 212.4050433979152, 208.37058707830008, 204.4127618853969, 200.53011227498462, 196.72121034968842, 192.984655333851, 189.31907305837836]，测线坐标为：[-1940.4670163653766, -1683.161607090619, -1430.7434990678144, -1183.1198620933742, -940.1996291958609, -701.8934631448666, -468.11372359602717, -238.77443486008994, -13.79125428418061, 206.91855876635807, 423.4361733369639, 635.8412167348791, 844.2118038131792, 1048.6245656985761, 1249.1546779735609, 1445.8758883232492, 1638.8605436571002, 1828.1796167154785]**

**第3块共53条测线，测线距离为：[108.33381413477578, 106.99492092500581, 105.67257504204686, 104.36657197815875, 103.07670975310425, 101.80278888291163, 100.54461234902351, 99.30198556782679, 98.07471636055944, 96.86261492358884, 95.66549379905786, 94.48316784589332, 93.31545421117313, 92.162172301847, 91.02314375680677, 89.89819241930208, 88.78714430969657, 87.68982759856127, 86.60607258010002, 85.53571164590379, 84.47857925902903, 83.4345119283966, 82.40334818350692, 81.38492854946774, 80.37909552233059, 79.38569354473188, 78.40456898183513, 77.4355700975706, 76.47854703116846, 75.53335177398208, 74.5998381465976, 73.6778617762267, 72.76728007437843, 71.86795221480723, 70.97973911173337, 70.10250339833263, 69.23610940549183, 68.3804231408268, 67.53531226795982, 66.70064608605313, 65.87629550959522, 65.06213304843729, 64.25803278807602, 63.4638703701804, 62.67952297335891, 61.90486929416466, 61.13978952833515, 60.38416535226384, 59.63787990470091, 58.90081776867991, 58.17286495366804, 57.45390887793686]，测线坐标为：[-2084.6750723929945, -1976.3412582582187, -1869.346337333213, -1763.673762291166, -1659.3071903130071, -1556.2304805599028, -1454.4276916769911, -1353.8830793279676, -1254.581093760141, -1156.5063773995814, -1059.6437624759926, -963.9782686769347, -869.4951008310413, -776.1796466198682, -684.0174743180212, -592.9943305612144, -503.0961381419123, -414.3089938322157, -326.6191662336545, -240.01309365355445, -154.47738200765065, -69.99880274862161, 13.435709179774989, 95.83905736328191, 177.22398591274964, 257.60308143508024, 336.9887749798121, 415.39334396164725, 492.8289140592178, 569.3074610903863, 644.8408128643683, 719.4406510109659, 793.1185127871926, 865.885792861571, 937.7537450763782, 1008.7334841881116, 1078.8359875864442, 1148.072096991936, 1216.4525201327629, 1283.9878324007227, 1350.688478486776, 1416.564773996371, 1481.6269070448084, 1545.8849398328844, 1609.3488102030647, 1672.0283331764235, 1733.9332024705882, 1795.0729919989233, 1855.457157351187, 1915.095037255888, 1973.9958550245678, 2032.168719978236, 2089.622628856173]**

**第4块共15条测线，测线距离为：[522.7248564830661, 469.1199228057403, 421.0121237660966, 377.8377334689272, 339.0908355699766, 304.3173949618266, 273.1099374027201, 245.10277474435574, 219.96771980800148, 197.41024069596216, 177.16600947472347, 158.997804787337, 142.69273209993992, 128.0597290093331]，测线坐标为：[-1896.7813295801827, -1374.0564730971166, -904.9365502913763, -483.9244265252797, -106.08669305635254, 233.00414251362406, 537.3215374754507, 810.4314748781708, 1055.5342496225264, 1275.5019694305279, 1472.91221012649, 1650.0782196012135, 1809.0760243885504, 1951.7687564884905, 2079.8284854978237]**

**第5块共23条测线，测线距离为：[239.3059726617269, 231.1797010986798, 223.32937872646104, 215.7456349554554, 208.41941739937155, 201.34198106980085, 194.50487793770353, 187.89994684936255, 181.51930378476825, 175.35533244680514, 169.4006751700081, 163.64822413803608, 158.0911128993797, 152.72270817117558, 147.5366019213442, 142.52660371959945, 137.68673334820065, 133.0112136636254, 128.4944637006439, 124.13109201056268, 119.91589022568573, 115.84382684231197]，测线坐标为：[-1864.1997288273637, -1624.893756165637, -1393.7140550669571, -1170.384676340496, -954.6390413850406, -746.219623985669, -544.8776429158681, -350.3727649781646, -162.47281812880203, 19.046485655966222, 194.40181810277136, 363.80249327277943, 527.4507174108155, 685.5418303101952, 838.2645384813708, 985.801140402715, 1128.3277441223145, 1266.0144774705152, 1399.0256911341405, 1527.5201548347845, 1651.6512468453473, 1771.567137071033, 1887.4109639133449]**

**测线总长度为588654.4845723937米**

**超过20%的测线长度：59799.56810747056**

**第四次：**

**D:\Anaconda\python.exe D:\python\Q4.py**

**归一化随机坐标：[0.56 0.036 0.76196388]，相应的原坐标：[4148.48 333.36 -62.18]**

**归一化随机坐标：[0.735 0.072 0.55451467]，相应的原坐标：[5444.88 666.72 -98.94]**

**归一化随机坐标：[0.35 0.288 0.93927765]，相应的原坐标：[2592.8 2666.88 -30.76]**

**归一化随机坐标：[0.365 0.22 0.93690745]，相应的原坐标：[2703.92 2037.2 -31.18]**

**归一化随机坐标：[0.165 0.2 0.99384876]，相应的原坐标：[1222.32 1852. -21.09]**

**聚类中心坐标：[[6409.17020595 2142.46098398 -116.74161184]**

**[5637.72983762 7062.07822733 -72.06211604]**

**[1856.05453529 7118.11327967 -58.41367957]**

**[1413.44768166 2388.58513649 -26.8106113 ]**

**[4113.76187527 2783.20948664 -54.98781396]]**

**法向量分别为：[[ 93.7112 -35.188 2743.9232]**

**[ -8.5192 0. -1371.9616]**

**[ -3.3336 -30.7432 -2743.9232]**

**[ 4.0744 3.704 1371.9616]**

**[ -48.8928 4.4448 -2743.9232]]**

**坡角（弧度制）分别为：[0.0364644 0.00620942 0.0112693 0.0040135 0.01789014]**

**坡角（角度制）分别为：[2.08925599 0.35577376 0.64568346 0.22995638 1.02502978]**

**[3167.695100793162, 2952.0829716701483, 2834.187213411941, 3035.1055280902037, 2984.136101834613]**

**每一块近似长度分别为：[4479.797373 4174.87577579 4008.14599551 4292.28740106 4220.20574718]**

**第1块共15条测线，测线距离为：[522.6175875169178, 469.0236541693919, 420.9257273862568, 377.760196955141, 339.02125035146076, 304.2549456408622, 273.0538921998438, 245.0524769233876, 219.92257998042828, 197.3697299144985, 177.12965303512178, 158.96517666581593, 142.66344996104903, 128.0334497257564]，测线坐标为：[-1896.1656102577463, -1373.5480227408284, -904.5243685714365, -483.5986411851797, -105.8384442300387, 233.18280612142206, 537.4377517622843, 810.4916439621281, 1055.5441208855157, 1275.466700865944, 1472.8364307804425, 1649.9660838155642, 1808.9312604813801, 1951.5947104424292, 2079.628160168186]**

**第2块共18条测线，测线距离为：[257.28176366878506, 252.3949115453602, 247.60088109470246, 242.8979092466969, 238.28426641927214, 233.75825588232308, 229.3182131337153, 224.9625052871414, 220.68953047160522, 216.49771724231164, 212.38552400274628, 208.35143843773253, 204.39397695725688, 200.51168415085843, 196.703132252382, 192.96692061489742, 189.30167519559265]，测线坐标为：[-1940.1718816227167, -1682.8901179539316, -1430.4952064085714, -1182.894325313869, -939.9964160671722, -701.7121496479, -467.95389376557694, -238.63568063186165, -13.67317534472025, 207.01635512688497, 423.5140723691966, 635.8995963719428, 844.2510348096754, 1048.6450117669324, 1249.1566959177908, 1445.8598281701727, 1638.82674878507, 1828.1284239806628]**

**第3块共23条测线，测线距离为：[239.299395321079, 231.17334710914875, 223.3232405035649, 215.73970517226348, 208.4136889777587, 201.33644717199843, 194.49953195813745, 187.8947824067688, 181.51431471457548, 175.3505127937764, 169.3960191811325, 163.64372625566145, 158.08676775457872, 152.71851057733727, 147.53254686798263, 142.52268636637325, 137.68294901913498, 133.00755784153066, 128.4909320217237, 124.12768025920491, 119.91259432943069, 115.84064286699106]，测线坐标为：[-1863.7783716007973, -1624.4789762797184, -1393.3056291705695, -1169.9823886670047, -954.2426834947412, -745.8289945169824, -544.492547344984, -349.99301538684654, -162.09823298007774, 19.416081734497737, 194.76659452827414, 364.1626137094066, 527.8063399650681, 685.8931077196469, 838.6116182969841, 986.1441651649668, 1128.66685153134, 1266.3498005504748, 1399.3573583920054, 1527.848290413729, 1651.975970672934, 1771.8885650023647, 1887.7292078693558]**

**第4块共53条测线，测线距离为：[108.3246175527905, 106.98583800320384, 105.6636043757066, 104.35771217991955, 103.0679594527517, 101.79414672716582, 100.53607700132962, 99.29355570814846, 98.06639068517455, 96.85439214488795, 95.65737264534503, 94.47514706118946, 93.30753255502172, 92.15434854912229, 91.0154166975243, 89.89056085843148, 88.7796070669769, 87.6823835083183, 86.59872049106608, 85.52845042103966, 84.47140777534817, 83.42742907679133, 82.396352868577, 81.37801968935099, 80.37227204853548, 79.37895440197232, 78.39791312786728, 77.42899650303167, 76.4720546794175, 75.52693966094276, 74.59350528060297, 73.67160717786574, 72.76110277634463, 71.86185126174898, 70.97371356010622, 70.09655231625337, 69.23023187259433, 68.3746182481197, 67.52957911768597, 66.6949837915507, 65.87070319516064, 65.05660984918971, 64.25257784982367, 63.458482849288394, 62.67420203661883, 61.89961411866569, 61.13459930133676, 60.37903927107018, 59.632817176536555, 58.895817610567356, 58.167926592306564, 57.449031549582905]，测线坐标为：[-2084.787192268653, -1976.4625747158627, -1869.476736712659, -1763.8131323369523, -1659.4554201570327, -1556.387460704281, -1454.5933139771153, -1354.0572369757856, -1254.7636812676371, -1156.6972905824625, -1059.8428984375746, -964.1855257922296, -869.7103787310401, -776.4028461760184, -684.2484976268961, -593.2330809293718, -503.3425200709403, -414.5629130039634, -326.8805294956451, -240.281809004579, -154.75335858353935, -70.28195080819118, 13.145478268600144, 95.54183113717714, 176.91985082652815, 257.2921228750636, 336.6710772770359, 415.0689904049032, 492.4979869079349, 568.9700415873524, 644.4969812482951, 719.090486528898, 792.7620937067638, 865.5231964831084, 937.3850477448574, 1008.3587613049637, 1078.455313621217, 1147.6855454938113, 1216.060163741931, 1283.589742859617, 1350.2847266511676, 1416.1554298463282, 1481.212039695518, 1545.4646175453415, 1608.92310039463, 1671.5973024312489, 1733.4969165499147, 1794.6315158512514, 1855.0105551223216, 1914.6433722988581, 1973.5391899094254, 2031.707116501732, 2089.1561480513146]**

**第5块共30条测线，测线距离为：[265.65878959916193, 251.60788278820593, 238.30013972691563, 225.69625388751686, 213.75899769606812, 202.45311257492213, 191.7452048009299, 181.60364687178833, 171.99848408920025, 162.90134608292712, 154.28536301440482, 146.12508621241804, 138.39641300641742, 131.07651553546287, 124.14377332251924, 117.57770941495158, 111.35892990260088, 105.46906663479743, 99.8907229671173, 94.60742237763658, 89.603559800913, 84.86435553595265, 80.37581159202107, 76.1246703433597, 72.09837537068748, 68.28503437382683, 64.67338404591088, 61.252756805421754, 58.01304928779836]，测线坐标为：[-1949.4692125747947, -1683.8104229756327, -1432.2025401874268, -1193.9024004605112, -968.2061465729944, -754.4471488769262, -551.9940363020041, -360.2488315010742, -178.6451846292859, -6.6467005400856465, 156.25464554284147, 310.5400085572463, 456.6650947696644, 595.0615077760818, 726.1380233115447, 850.2817966340639, 967.8595060490154, 1079.2184359516164, 1184.6875025864138, 1284.578225553531, 1379.1856479311675, 1468.7892077320805, 1553.6535632680332, 1634.0293748600543, 1710.154045203414, 1782.2524205741015, 1850.5374549479284, 1915.2108389938392, 1976.463595799261, 2034.4766450870593]**

**测线总长度为588629.4871275553米**

**超过20%的测线长度：59803.69699931396**

**第五次：**

**D:\Anaconda\python.exe D:\python\Q4.py**

**归一化随机坐标：[0.1 0.46 0.94108352]，相应的原坐标：[ 740.8 4259.6 -30.44]**

**归一化随机坐标：[0.135 0.236 0.99153499]，相应的原坐标：[1000.08 2185.36 -21.5 ]**

**归一化随机坐标：[0.915 0.04 0.2229684]，相应的原坐标：[6778.32 370.4 -157.69]**

**归一化随机坐标：[0.27 0.044 0.97257336]，相应的原坐标：[2000.16 407.44 -24.86]**

**归一化随机坐标：[0.165 0.872 0.73086907]，相应的原坐标：[1222.32 8074.72 -67.69]**

**聚类中心坐标：[[1855.56588475 7118.17455593 -58.41330169]**

**[1413.0042419 2388.75771176 -26.80834151]**

**[6409.08527957 2142.74254826 -116.73640355]**

**[4112.86249947 2781.86275408 -54.97472523]**

**[5637.02089088 7061.29357789 -72.05639675]]**

**法向量分别为：[[ -3.3336 -30.7432 -2743.9232]**

**[ 4.0744 3.704 1371.9616]**

**[ 93.7112 -35.188 2743.9232]**

**[ -48.8928 4.4448 -2743.9232]**

**[ -8.5192 0. -1371.9616]]**

**坡角（弧度制）分别为：[0.0112693 0.0040135 0.0364644 0.01789014 0.00620942]**

**坡角（角度制）分别为：[0.64568346 0.22995638 2.08925599 1.02502978 0.35577376]**

**[2833.8209162698367, 3034.7463151282013, 3167.454683475475, 2982.5556316232555, 2952.194072958037]**

**每一块近似长度分别为：[4007.62797313 4291.77939722 4479.45737157 4217.97062477 4175.03289673]**

**第1块共23条测线，测线距离为：[239.28965520913144, 231.16393774863988, 223.3141506629488, 215.73092400139137, 208.4052059949274, 201.32825225143895, 194.49161531792834, 187.88713459715964, 181.50692660670737, 175.34337556878518, 169.38912431962197, 163.63706552753422, 158.0803332092123, 152.71229453409364, 147.52654190704044, 142.5168853198708, 137.67734496261443, 133.00214408567263, 128.4857021043624, 124.12262793761465, 119.90771357287416, 115.83592784952063]，测线坐标为：[-1863.5250707663042, -1624.2354155571727, -1393.0714778085328, -1169.757327145584, -954.0264031441926, -745.6211971492652, -544.2929448978263, -349.8013295798979, -161.91419498273828, 19.592731623969087, 194.93610719275426, 364.32523151237626, 527.9622970399105, 686.0426302491228, 838.7549247832164, 986.2814666902568, 1128.7983520101277, 1266.475696972742, 1399.4778410584147, 1527.9635431627771, 1652.0861711003918, 1771.993884673266, 1887.8298125227866]**

**第2块共53条测线，测线距离为：[108.3145592994664, 106.97590405942417, 105.6537932051347, 104.3480222652063, 103.05838929530094, 101.78469484690238, 100.52674193647051, 99.2843360149769, 98.0572849378165, 96.84539893509177, 95.64849058226352, 94.4663747711649, 93.29886868137336, 92.14579175193653, 91.00696565344748, 89.88221426046526, 88.771363624276, 87.67424194599099, 86.59067954997697, 85.52050885761497, 84.46356436138333, 83.4196825992612, 82.38870212944812, 81.37046350539632, 80.36480925115146, 79.37158383699814, 78.3906336554063, 77.42180699727525, 76.46495402847079, 75.51992676665276, 74.58657905838872, 73.66476655655057, 72.75434669799053, 71.85517868149292, 70.96712344599858, 70.09004364909838, 69.2238036457924, 68.36826946751181, 67.5233088013998, 66.68879096984888, 65.86458691029077, 65.05056915523618, 64.24661181256141, 63.4525905460384, 62.668382556105435, 61.89386656087565, 61.12892277738005, 60.37343290304254, 59.62728009738371, 58.89034896395093, 58.162525532471584, 57.44369724122712]，测线坐标为：[-2084.5388874761748, -1976.2243281767082, -1869.248424117284, -1763.5946309121493, -1659.246608646943, -1556.1882193516421, -1454.4035245047398, -1353.8767825682694, -1254.5924465532926, -1156.535161615476, -1059.6897626803843, -964.0412720981208, -869.5748973269559, -776.2760286455825, -684.130236893646, -593.1232712401986, -503.24105697973334, -414.46969335545737, -326.7954514094664, -240.20477185948943, -154.68426300187446, -70.22069864049112, 13.198983958770071, 95.58768608821819, 176.9581495936145, 257.32295884476594, 336.69454268176406, 415.08517633717037, 492.50698333444564, 568.9719373629164, 644.4918641295692, 719.0784431879579, 792.7432097445085, 865.497556442499, 937.3527351239919, 1008.3198585699905, 1078.409902219089, 1147.6337058648814, 1216.0019753323932, 1283.5252841337929, 1350.2140751036418, 1416.0786620139324, 1481.1292311691686, 1545.37584298173, 1608.8284335277685, 1671.496816083874, 1733.3906826447496, 1794.5196054221296, 1854.8930383251723, 1914.5203184225559, 1973.4106673865067, 2031.5731929189783, 2089.0168901602055]**

**第3块共15条测线，测线距离为：[522.5875399261909, 468.9966879303323, 420.9015265092005, 377.73847785486157, 339.00175852412536, 304.2374526817625, 273.0381931269554, 245.0383877753966, 219.90993566107758, 197.358382257994, 177.1194690699298, 158.95603705650623, 142.65524760992554, 128.02608851788932]，测线坐标为：[-1896.015372273088, -1373.427832346897, -904.4311444165647, -483.52961790736424, -105.79114005250267, 233.2106184716227, 537.4480711533852, 810.4862642803405, 1055.524652055737, 1275.4345877168146, 1472.7929699748086, 1649.9124390447384, 1808.8684761012446, 1951.52372371117, 2079.549812229059]**

**第4块共30条测线，测线距离为：[265.56402004588915, 251.51812567274317, 238.21512993740015, 225.6157403340653, 213.68274256914285, 202.38089064292294, 191.67680274493694, 181.5388626554907, 171.93712636214997, 162.84323361535502, 154.2303241619299, 146.07295840906852, 138.34704228446628, 131.02975607065991, 124.09948700337604, 117.5357654348073, 111.31920437326404, 105.43144222062253, 99.85508853843538, 94.57367268251618, 89.57159515428188, 84.8340815251621, 80.34713879798322, 76.09751407643412, 72.0726554205368, 68.26067477250291, 64.65031284347137, 61.230905857414584, 57.99235405398624]，测线坐标为：[-1948.4089548778265, -1682.8449348319373, -1431.326809159194, -1193.1116792217938, -967.4959388877285, -753.8131963185856, -551.4323056756626, -359.7555029307257, -178.216640275235, -6.279513913085026, 156.56371970227, 310.7940438641999, 456.86700227326844, 595.2140445577347, 726.2438006283946, 850.3432876317706, 967.879053066578, 1079.198257439842, 1184.6296996604647, 1284.4847881989, 1379.0584608814163, 1468.630056035698, 1553.4641375608603, 1633.8112763588435, 1709.9087904352778, 1781.9814458558146, 1850.2421206283175, 1914.8924334717888, 1976.1233393292034, 2034.1156933831896]**

**第5块共18条测线，测线距离为：[257.26593333838036, 252.37938189885415, 247.5856464208557, 242.8829639427502, 238.26960498888602, 233.7438729335565, 229.3041033770425, 224.9486635335069, 220.67595163051521, 216.48439631996203, 212.37245610018613, 208.3386187490623, 204.38140076786118, 200.49934683567204, 196.69102927418882, 192.95504752266208, 189.29002762282352]，测线坐标为：[-1940.2595032502165, -1682.9935699118362, -1430.6141880129821, -1183.0285415921264, -940.1455776493763, -701.8759726604902, -468.1320997269337, -238.82799634989118, -13.879332816384277, 206.79661881413094, 423.28101513409297, 635.6534712342791, 843.9920899833414, 1048.3734907512026, 1248.8728375868745, 1445.5638668610634, 1638.5189143837256, 1827.8089420065492]**

**测线总长度为588521.322892374米**

**超过20%的测线长度：59789.67647125623**