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1.5. Meteorite Landing (10 points)

The NASA's Open Data Portal hosts a comprehensive data set from The Meteoritical Society that contains information on all of the known meteorite landings. The Table `Meteorite_Landings.csv` (downloaded from <https://data.nasa.gov/Space-Science/Meteorite-Landings/gh4g-9sfh>) consists of 34,513 meteorites and includes fields like the type of meteorite, the mass and the year. You should remove the header line before starting on this task. Use the command `sed '1d' Meteorite_Landings.csv > tmpfile; mv tmpfile Meteorite_Landings.csv`. Note that if you download the data from the course site, you do not need to remove the header because it is not present.

Write a MapReduce job to calculate the average mass per type of meteorite. The type of meteorite is included in the fourth column under the *recclass* column. Use the design patterns explained in class.

```
$ ./P15_mapper.py < Meteorite_Landings.csv | sort | ./P15_reducer.py
```

Submission

- `P15_mapper.py`: Mapper script
- `P15_reducer.py`: Reducer script
- `P15.pdf`: The command line that you used to execute the job and any information required to reproduce the execution

Command Used:

```
./P15_mapper.py < Meteorite_Landings.csv | sort | ./P15_reducer.py
```

Output:

```
admin@C02D36V0ML85 problem_1 % ./P15_mapper.py < Meteorite_Landings.csv |
sort | ./P15_reducer.py
Acapulcoite 490.424407407
Acapulcoite/Lodranite 31.7933333333
Acapulcoite/lodranite 44.9333333333
Achondrite-prim 1078.0
Achondrite-ung 895.845614035
Angrite 1382.37
Aubrite 67150.6133333
Aubrite-an 8390.77
Brachinite 565.04030303
C 156.4475
C1/2-ung 41.73
C2 0.8
C2-ung 1129.10142857
C3-ung 617.566666667
C3.0-ung 286.0
C3/4-ung 12.0
C4 28.97
C4-ung 1749.33333333
C4/5 226.0
C5/6-ung 169.2
C6 83.2
CB 97.425
CBa 44043.2
CBb 653.56
```

CH/CBb 16000.0
CH3 223.730952381
CH3 74.0
CI1 2390.19288889
CK 120.733333333
CK3 214.656923077
CK3-an 540.6
CK3.8 195.0
CK3/4 167.0
CK4 1276.9618
CK4-an 2932.66666667
CK4/5 241.565833333
CK5 131.56787234
CK5/6 145.733333333
CK6 103.322352941
CM 359.89
CM-an 66.0
CM1 45.6857894737
CM1/2 175.799444444
CM2 368.379615942
CM2-an 12.7
C03 510.319955224
C03 308.0
C03.0 1150.16
C03.1 303.316666667
C03.2 25598.88875
C03.3 4314.80142857
C03.4 1415.594
C03.5 4799.423333333
C03.6 1010.118333333
C03.7 1600.0
C03.8 7901.666666667
CR 271.8225
CR-an 114000.0
CR1 57.55
CR2 226.896888889
CR2-an 160.0
CR7 868.0
CV2 30.6
CV3 8953.69018359
CV3-an 825.8
Chondrite-fusion crust 0.71
Chondrite-ung 997.562
Diogenite 899.461452282
Diogenite-an 261.866666667
Diogenite-olivine 747.577777778
Diogenite-pm 2209.54545455
E 57210.8842857
E-an 18.86
E3 2.38762135922
E3-an 25.6666666667
E4 42.6875
E5 1.098
E5-an 9.77
E6 345.257777778
EH 0.59
EH-imp melt 82.7033333333
EH3 293.863583333

EH3/4-an 28.0
EH4 7701.78222222
EH4/5 39.2888888889
EH5 4654.03833333
EH6 92.9466
EH6-an 75.61
EH7 2427.9
EH7-an 4720.0
EL-melt rock 8.3
EL3 135.749473684
EL3/4 34.6
EL4 234.976153846
EL4/5 608.9
EL5 593.983333333
EL6 1993.53269444
EL6 68.15
EL6/7 58150.0
EL7 421.0
Enst achon 219.633333333
Enst achon-ung 3147.66666667
Eucrite 436.198764706
Eucrite-Mg rich 207.925
Eucrite-an 6463.0
Eucrite-br 179.689
Eucrite-cm 2063.80769231
Eucrite-mmict 5963.28601852
Eucrite-pmict 481.821304348
Eucrite-unbr 89.05875
Fusion crust 0.07825
H 3537.49284146
H(5?) 159.9
H(?)4 16.16
H(L)3 791.05
H(L)3-an 271.0
H-an 24.455
H-imp melt 11.86
H-melt breccia 47.0925
H-melt rock 121.8375
H-metal 10.67
H/L3 150.533333333
H/L3-4 2000.0
H/L3.5 1001.0
H/L3.6 28000.0
H/L3.7 47.83
H/L3.9 7250.0
H/L4 1456.98846154
H/L4-5 1575.3
H/L4/5 96.8
H/L5 289.575714286
H/L6 86.2209090909
H/L6-melt rock 436.4
H/L~4 411.0
H3 796.078378238
H3 10.55
H3-4 9010.016
H3-5 1565.57410256
H3-6 6941.47837209
H3-an 61.4

H3.0 182.85
H3.0-3.4 738.0
H3.05 78.2
H3.1 187.6
H3.10 330.0
H3.15 730.0
H3.2 88.385
H3.2-3.7 17.7
H3.2-6 83.9
H3.2-an 524.433333333
H3.3 414.214285714
H3.4 652.2410625
H3.4-5 230.3
H3.4/3.5 499.5
H3.5 838.190555556
H3.5-4 167.3
H3.6 7203.91271429
H3.6-6 623.4
H3.7 3635.49826667
H3.7-5 2048.3705
H3.7-6 97.8
H3.7/3.8 208.6
H3.8 1473.99105263
H3.8-4 50000.0
H3.8-5 125.0
H3.8-6 890.345
H3.8-an 2135.5
H3.8/3.9 50.13
H3.8/4 351.0
H3.9 836.280697674
H3.9-5 161.0
H3.9-6 171.0475
H3.9/4 5587.546
H3/4 514.527457143
H4 997.419549988
H4 8.66
H4(?) 0.4
H4-5 747.896744681
H4-6 1615.70731343
H4-an 312.901
H4-melt breccia 468.0
H4/5 1601.55790888
H4/6 1493.01666667
H5 2166.0914102
H5 831.505909091
H5-6 2883.48730159
H5-7 3891.0
H5-an 25.95
H5-melt breccia 509.75
H5/6 837.394041451
H6 862.366988292
H6 3.36
H6-melt breccia 332.426666667
H6/7 68.5
H7 228.466666667
H? 430.1
Howardite 652.054125
Howardite-an 494.0

H~4 592.688888889
H~4/5 256.433333333
H~5 820.320540541
H~6 791.446363636
Impact melt breccia 172.0
Iron 32316.3057895
Iron, IAB complex 180809.197843
Iron, IAB-MG 1301547.23133
Iron, IAB-an 2154.333333333
Iron, IAB-sHH 3862.2
Iron, IAB-sHL 9438.26117647
Iron, IAB-sHL-an 762.0
Iron, IAB-sLH 7382.566666667
Iron, IAB-sLL 164194.640741
Iron, IAB-sLM 19816.1
Iron, IAB-ung 686004.967391
Iron, IAB? 1582.75
Iron, IC 892556.3
Iron, IC-an 35000.0
Iron, IIAB 322715.860171
Iron, IIAB-an 59.0
Iron, IIC 26483.375
Iron, IID 67423.6157895
Iron, IID-an 11790.0
Iron, IIE 42413.0
Iron, IIE-an 53137.0457143
Iron, IIE? 4.6
Iron, IIF 11156.0
Iron, IIG 24303.166666667
Iron, IIIAB 488805.946972
Iron, IIIAB-an 240233.333333
Iron, IIIAB? 7795.5
Iron, IIIE 2076114.42857
Iron, IIIE-an 58400.0
Iron, IIIF 55777.266666667
Iron, IVA 463545.479104
Iron, IVA-an 73986.666666667
Iron, IVB 4322832.85714
Iron, ungrouped 422159.398584
Iron? 2250.0
K 23.1
K3 180.5
L 3130.59006
L(?)3 10.235
L(H)3 65.7
L(LL)3 55.86
L(LL)3.05 491.55
L(LL)3.5-3.7 1228.1
L(LL)5 1056.0
L(LL)6 265.0
L(LL)~4 331.0
L-imp melt 948.5056
L-melt breccia 237.87
L-melt rock 2268.9847619
L-metal 1.0254
L/LL 11.8
L/LL(?)3 2.0
L/LL-melt rock 23.2

L/LL3 357.93
L/LL3-5 413.766666667
L/LL3-6 68.0
L/LL3.10 287.0
L/LL3.2 1608.2
L/LL3.4 2994.5275
L/LL3.5 32.4
L/LL3.6/3.7 2618.0
L/LL4 22547.43335
L/LL4-6 3650.0
L/LL4/5 789.2
L/LL5 39847.48125
L/LL5-6 3287.0
L/LL5/6 350.8
L/LL6 12365.5107692
L/LL6-an 5900.0
L/LL~4 23.6
L/LL~5 315.35
L/LL~6 700.9
L3 1534.4467863
L3-4 284.75
L3-5 945.692307692
L3-6 3800.45625
L3-7 122.25
L3-melt breccia 1604.0
L3.0 96.505
L3.0-3.7 50.1
L3.0-3.9 424.1
L3.00 81.0
L3.05 231.15
L3.1 876.143846154
L3.10 404.0
L3.2 1153.79133333
L3.2-3.5 351.7
L3.2-3.6 65.3
L3.3 442.125882353
L3.3-3.5 4.9
L3.3-3.6 203.3
L3.3-3.7 15.4
L3.4 273.995098039
L3.4-3.7 272.0
L3.5 561.355681818
L3.5-3.7 149.5
L3.5-3.8 73.0
L3.5-3.9 325.8
L3.5-5 5590.0
L3.6 1773.05958333
L3.6-4 153.2
L3.7 1082.17
L3.7-3.9 1470.0
L3.7-4 31.4
L3.7-6 6100.0
L3.7/3.8 350.0
L3.8 828.068181818
L3.8-5 345.55
L3.8-6 340.333333333
L3.8-an 14040.0
L3.9 1513.54666667

L3.9-5 31.94
L3.9-6 186.0
L3.9/4 402.0
L3/4 156.059166667
L4 1635.880249
L4 66.0133333333
L4-5 9275.75333333
L4-6 70540.4712121
L4-an 57.2
L4-melt breccia 5200.0
L4-melt rock 758.1
L4/5 1666.98520339
L5 1797.35170275
L5 12.959047619
L5-6 8938.00219512
L5-7 929.4
L5-melt breccia 2198.66666667
L5/6 2302.9493578
L6 1450.44428373
L6 30.3485185185
L6-melt breccia 844.34
L6-melt rock 22000.0
L6/7 5855.36888889
L7 661.403809524
LL 103.210222222
LL(L)3 995.271428571
LL(L)3.1 3200.0
LL-imp melt 92.65
LL-melt breccia 44.5061111111
LL-melt rock 537.257142857
LL3 448.276429687
LL3-4 383.0
LL3-5 113.565
LL3-6 2142.63555556
LL3.0 75.5575
LL3.00 691.0
LL3.05 128.0
LL3.1 1405.865
LL3.1-3.5 80.1
LL3.10 552.066666667
LL3.15 387.103333333
LL3.2 4478.73
LL3.3 645.556666667
LL3.4 1283.823
LL3.5 390.485882353
LL3.6 4852.04941176
LL3.7 3452.72653846
LL3.7-6 226.806
LL3.8 603.892142857
LL3.8-4 3500.0
LL3.8-6 916.666666667
LL3.9 1586.9525
LL3.9/4 18.6
LL3/4 1452.0
LL4 874.71369403
LL4-5 199.65
LL4-6 927.053529412
LL4/5 873.78

```

LL4/6    35.0
LL5  464.675883948
LL5-6    917.4825
LL5-7    87.4
LL5/6    162.35625
LL6  691.826736172
LL6      155.595
LL6(?)   293.6
LL6-an   2730.0
LL6-melt breccia    126.0
LL6/7    533.75
LL7  200.234545455
LL7(?)    8.0
LL<3.5   200.0
LL~3     19.8666666667
LL~4     28.7
LL~4/5   23.8
LL~5     60.5322222222
LL~6     413.222
Lodranite 268.9335
Lodranite-an 13.8
Lunar    536.849268293
Lunar (anorth) 147.867826087
Lunar (bas. breccia) 79.0
Lunar (bas/anor) 5.585
Lunar (bas/gab brec) 191.2
Lunar (basalt) 1027.10875
Lunar (feldsp. breccia) 500.588888889
Lunar (gabbro) 413.531666667
Lunar (norite) 633.0
L~3  362.7
L~4  376.18
L~4-6  45.0
L~5  805.2615625
L~6  555.90212766
Martian 9.3
Martian (OPX) 1930.9
Martian (basaltic breccia) 200.0
Martian (chassignite) 2305.5
Martian (nakhlite) 2058.71428571
Martian (shergottite) 879.028535354
Mesosiderite 4135.12858824
Mesosiderite-A 6234.75
Mesosiderite-A1 698206.333333
Mesosiderite-A2 4949.0
Mesosiderite-A3 30666.6666667
Mesosiderite-A3/4 320000.0
Mesosiderite-A4 19166.6666667
Mesosiderite-B 2257.75
Mesosiderite-B1 1324.375
Mesosiderite-B2 11857.342
Mesosiderite-B4 359333.333333
Mesosiderite-C 34843.8571429
Mesosiderite-C2 25613.0
Mesosiderite-an 2008.81666667
Mesosiderite? 414.0
OC  3133.01753425
OC3 940.7625

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Pallasite 6319.56
Pallasite, PES 42167.5
Pallasite, PMG 147304.736842
Pallasite, PMG-an 685358.909091
Pallasite, ungrouped 7310.786
Pallasite? 14180.0
R 66.3533333333
R3 87.7406666667
R3-4 171.0
R3-5 604.216666667
R3-6 204.45
R3.4 10.5
R3.5-4 248.0
R3.5-6 205.0
R3.6 690.466666667
R3.7 236.0
R3.8 301.346666667
R3.8-5 174.0
R3.8-6 266.55
R3.9 3055.7475
R3/4 80.65
R4 226.046190476
R4/5 184.0
R5 1359.824
R6 61.8911111111
Relict OC 0.0
Relict iron 0.0
Stone-uncl 10750.5283333
Stone-ung 0.63
Ureilite 490.0149
Ureilite-an 1287.125
Ureilite-pmict 262.685652174
Winonaite 1129.0132