Day 3 Exercises: Loops, Conditionals, and Functions

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here

Use the here command to load in the gapminder5.csv

```
library(here)
```

```
## here() starts at /Users/sarahmoore/Box Sync/Misc/MSIA-bootcamp-2020
```

```
here()
```

```
## [1] "/Users/sarahmoore/Box Sync/Misc/MSIA-bootcamp-2020"
```

```
gapminder<-read.csv(here::here("data", "gapminder5.csv"))
```

Inspect the dataset and the variable classes to make sure that they have the proper attributes (e.g. change factors to characters).

```
head(gapminder)
```

```
##         country year       pop continent lifeExp gdpPercap
## 1 Afghanistan 1952   8425333      Asia  28.801  779.4453
## 2 Afghanistan 1957   9240934      Asia  30.332  820.8530
## 3 Afghanistan 1962 10267083      Asia  31.997  853.1007
## 4 Afghanistan 1967 11537966      Asia  34.020  836.1971
## 5 Afghanistan 1972 13079460      Asia  36.088  739.9811
## 6 Afghanistan 1977 14880372      Asia  38.438  786.1134
```

```
str(gapminder)
```

```
## 'data.frame':    1704 obs. of  6 variables:
##  $ country  : Factor w/ 142 levels "Afghanistan",..: 1 1 1 1 1 1 1 1 1 1 1 ...
##  $ year     : int  1952 1957 1962 1967 1972 1977 1982 1987 1992 1997 ...
##  $ pop      : num  8425333 9240934 10267083 11537966 13079460 ...
##  $ continent: Factor w/ 5 levels "Africa","Americas",..: 3 3 3 3 3 3 3 3 3 3 ...
##  $ lifeExp  : num  28.8 30.3 32 34 36.1 ...
##  $ gdpPercap: num  779 821 853 836 740 ...
```

```
gapminder$country<-as.character(gapminder$country)
gapminder$continent<-as.character(gapminder$continent)
```

Create a vector for each i observation in the dataset.

```
obs<-1:nrow(gapminder)
```

For Loops

Using a `for` command, create a variable that measures the life expectancy of each country-year unit in months. Call this variable 'lifeExp_months

```
for(i in obs){
  gapminder[i, "lifeExp_months"]<- gapminder[i,"lifeExp"]*12
}
gapminder$lifeExp_months
```

```
##    [1] 345.6120 363.9840 383.9640 408.2400 433.0560 461.2560 478.2480 489.8640
##    [9] 500.0880 501.1560 505.5480 525.9360 662.7600 711.3600 777.8400 794.6400
##   [17] 812.2800 827.1600 845.0400 864.0000 858.9720 875.4000 907.8120 917.0760
##   [25] 516.9240 548.2200 579.6360 616.8840 654.2160 696.1680 736.4160 789.5880
##   [33] 812.9280 829.8240 851.9280 867.6120 360.1800 383.9880 408.0000 431.8200
##   [41] 455.1360 473.7960 479.3040 478.8720 487.7640 491.5560 492.0360 512.7720
##   [49] 749.8200 772.7880 781.7040 787.6080 804.7800 821.7720 839.3040 849.2880
##   [57] 862.4160 879.3000 892.0800 903.8400 829.4400 843.9600 851.1600 853.2000
##   [65] 863.1600 881.8800 896.8800 915.8400 930.7200 945.9600 964.4400 974.8200
##   [73] 801.6000 809.7600 834.4800 841.6800 847.5600 866.0400 878.1600 899.2800
##   [81] 912.4800 930.1200 947.7600 957.9480 611.2680 645.9840 683.0760 719.0760
##   [89] 759.6000 787.1160 828.6240 849.0000 871.2120 887.1000 897.5400 907.6200
##   [97] 449.8080 472.1760 494.5920 521.4360 543.0240 563.0760 600.1080 633.8280
##  [105] 672.2160 712.9440 744.1560 768.7440 816.0000 830.8800 843.0000 851.2800
##  [113] 857.2800 873.6000 887.1600 904.2000 917.5200 930.3600 939.8400 953.2920
##  [121] 458.6760 484.2960 511.4160 538.6200 564.1680 590.2800 610.8480 628.0440
##  [129] 647.0280 657.3240 652.8720 680.7360 484.9680 502.6800 521.1360 540.3840
##  [137] 560.5680 600.2760 646.3080 687.0120 719.4840 744.6000 766.5960 786.6480
##  [145] 645.8400 701.4000 743.1600 777.4800 809.4000 838.3200 848.2800 853.6800
##  [153] 866.1360 878.9280 889.0800 898.2240 571.4640 595.4160 618.2400 639.5760
##  [161] 672.2880 711.8280 737.8080 763.4640 752.9400 630.6720 559.6080 608.7360
##  [169] 611.0040 639.4200 667.9800 691.5840 714.0480 737.8680 760.0320 782.4600
##  [177] 804.6840 832.6560 852.0720 868.6800 715.2000 799.3200 834.1200 845.0400
##  [185] 850.8000 849.7200 852.9600 856.0800 854.2800 843.8400 865.6800 876.0600
##  [193] 383.7000 418.8720 453.7680 488.3640 523.0920 553.6440 577.4640 594.6840
##  [201] 603.1200 603.8880 607.8000 627.5400 468.3720 486.3960 504.5400 522.5760
##  [209] 528.6840 550.9200 569.6520 578.5320 536.8320 543.9120 568.3200 594.9600
##  [217] 473.0040 496.3920 520.9800 544.9800 483.8040 374.6400 611.4840 646.9680
##  [225] 669.6360 678.4080 681.0240 716.6760 462.2760 485.1360 511.7160 537.5880
##  [233] 564.5880 592.2600 635.5320 659.8200 651.7680 626.3880 598.2720 605.1600
##  [241] 825.0000 839.5200 855.6000 865.5600 874.5600 890.5200 909.1200 922.3200
##  [249] 935.4000 943.3200 957.2400 967.8360 425.5560 449.5680 473.7000 497.7360
##  [257] 521.4840 561.3000 579.5400 605.8200 592.7520 552.7920 519.6960 536.8920
##  [265] 457.1040 478.5720 500.5920 523.2120 546.8280 568.5960 594.2040 612.6120
##  [273] 620.6880 618.8760 606.3000 607.8120 656.9400 672.8880 695.0880 726.2760
##  [281] 761.2920 804.6240 846.7800 869.9040 889.5120 909.7920 934.3200 942.6360
##  [289] 528.0000 606.5875 534.0163 700.5734 757.4266 767.6083 786.3000 807.2880
##  [297] 824.2800 845.1120 864.3360 875.5320 607.7160 661.4160 694.3560 719.5560
##  [305] 739.4760 766.0440 799.8360 813.2160 821.0520 843.7560 860.1840 874.6680
##  [313] 488.5800 509.5200 533.6040 557.6640 587.3280 611.2680 635.1960 659.1120
##  [321] 695.2680 727.9200 755.6880 781.8240 469.7160 487.8240 505.4640 528.6720
##  [329] 551.8680 573.6480 573.4080 568.9440 546.5760 511.0440 539.5920 557.5440
##  [337] 505.3320 540.6360 581.2200 624.4800 658.8840 667.5000 680.3400 689.6400
##  [345] 677.1960 635.5440 635.6400 663.8640 686.4720 720.3120 754.1040 785.0880
##  [353] 814.1880 849.0000 881.4000 897.0240 908.5560 927.1200 937.4760 945.3840
```

```
## [361] 485.7240 509.6280 539.1600 568.2000 597.6120 628.4880 647.7960 655.8600
## [369] 624.5280 575.8920 561.9840 579.9360 734.5200 777.2400 805.5600 822.0000
## [377] 835.3200 847.6800 845.5200 858.2400 870.3240 884.1600 898.5120 908.9760
## [385] 713.0520 747.9000 782.9520 819.4800 848.6760 871.7880 884.6040 890.0880
## [393] 892.9680 913.8120 925.8960 939.2760 802.4400 828.3600 838.8000 844.5600
## [401] 843.4800 848.5200 851.5200 858.9600 868.8000 888.1200 906.1200 917.8320
## [409] 849.3600 861.7200 868.2000 875.5200 881.6400 896.2800 895.5600 897.6000
## [417] 903.9600 913.3200 926.1600 939.9840 417.7440 447.9360 476.3160 504.8880
## [425] 532.3920 558.2280 585.7440 600.4800 619.2480 637.8840 640.4760 657.4920
## [433] 551.1360 597.9360 641.5080 681.0120 715.5720 741.4560 764.7240 792.5520
## [441] 821.4840 839.4840 850.1640 866.8200 580.2840 616.2720 655.6800 680.1360
## [449] 705.5520 735.7200 772.1040 806.7720 835.3560 867.7440 890.0760 899.9280
## [457] 502.7160 533.3280 563.9040 591.5160 613.6440 639.8280 672.0720 717.5640
## [465] 764.0880 806.6040 837.6720 856.0560 543.1440 582.8400 627.6840 670.2600
## [473] 698.4840 680.3520 679.2480 757.8480 801.5760 834.4200 848.8080 862.5360
## [481] 413.7840 431.7960 449.8200 467.8440 486.1920 504.2880 523.9440 547.9680
## [489] 570.5400 578.9400 592.1760 618.9480 431.1360 456.5640 481.8960 506.2680
## [497] 529.7040 534.4200 526.6800 557.4360 599.8920 640.5360 662.8800 696.4800
## [505] 408.9360 440.0040 480.7080 505.3800 522.1800 534.1200 538.9920 560.2080
## [513] 577.0920 592.8240 608.7000 635.3640 798.6000 809.8800 825.0000 837.9600
## [521] 850.4400 870.2400 894.6000 897.9600 908.4000 925.5600 940.4400 951.7560
## [529] 808.9200 827.1600 846.1200 858.6000 868.5600 885.9600 898.6800 916.0800
## [537] 929.5200 943.6800 955.0800 967.8840 444.0360 467.9880 485.8680 535.1760
## [545] 584.2800 633.4800 678.7680 722.2800 736.3920 725.5320 681.1320 680.8200
## [553] 360.0000 384.7800 406.7520 430.2840 459.6960 502.1040 546.9600 591.1800
## [561] 631.7280 670.3320 696.4920 713.3760 810.0000 829.2000 843.6000 849.6000
## [569] 852.0000 870.0000 885.6000 898.1640 912.8400 928.0800 944.0400 952.8720
## [577] 517.7880 537.3480 557.4240 576.8640 598.5000 621.0720 644.9280 668.7480
## [585] 690.0120 702.6720 701.4360 720.2640 790.3200 814.3200 834.1200 852.0000
## [593] 868.0800 884.1600 902.8800 920.0400 924.3600 934.4280 939.0720 953.7960
## [601] 504.2760 529.7040 563.4480 600.1920 644.8560 672.3480 697.6440 729.3840
## [609] 760.4760 795.8640 827.7360 843.1080 403.3080 414.6960 429.0360 446.3640
## [617] 466.1040 489.1440 514.6920 546.6240 582.9120 617.4600 644.1120 672.0840
## [625] 390.0000 401.8680 413.8560 425.9040 437.8320 449.5800 471.9240 494.9400
## [633] 519.1920 538.4760 546.0480 556.6560 450.9480 488.3520 523.0800 554.9160
## [641] 576.5040 599.0760 617.5320 643.6320 661.0680 680.0520 697.6440 730.9920
## [649] 502.9440 535.9800 576.4920 611.0880 646.6080 688.8240 730.9080 773.9040
## [657] 796.7880 811.9080 822.7800 842.3760 731.5200 777.0000 811.8000 840.0000
## [665] 864.0000 883.2000 905.4000 914.4000 931.2120 960.0000 977.9400 986.4960
## [673] 768.3600 796.9200 815.5200 834.0000 837.1200 839.4000 832.6800 834.9600
## [681] 830.0400 852.4800 871.0800 880.0560 869.8800 881.6400 884.1600 884.7600
## [689] 893.5200 913.3200 923.8800 926.7600 945.2400 947.4000 966.0000 981.0840
## [697] 448.4760 482.9880 523.2600 566.3160 607.8120 650.4960 679.1520 702.6360
## [705] 722.6760 741.1800 754.5480 776.3760 449.6160 479.0160 510.2160 551.5680
## [713] 590.4360 632.4240 673.9080 721.6440 752.1720 792.4920 823.0560 847.8000
## [721] 538.4280 566.1720 591.9000 629.6280 662.8080 692.4240 715.4400 756.4800
## [729] 788.9040 816.5040 833.4120 851.5680 543.8400 581.2440 617.4840 653.5080
## [737] 683.4000 724.9560 744.4560 780.5280 713.5320 705.7320 684.5520 714.5400
## [745] 802.9200 826.8000 843.4800 852.9600 855.3600 864.3600 877.2000 892.3200
## [753] 905.6040 913.4640 933.3960 946.6200 784.6800 814.0800 832.6800 849.0000
## [761] 859.5600 876.7200 893.4000 907.2000 923.1600 939.2280 956.3520 968.9400
## [769] 791.2800 813.7200 830.8800 852.7200 866.2800 881.7600 899.7600 917.0400
## [777] 929.2800 945.8400 962.8800 966.5520 702.3600 751.3200 787.3200 810.1200
## [785] 828.0000 841.3200 854.5200 861.2400 861.1920 867.1440 864.5640 870.8040
```

```
##  [793] 756.3600 786.0000 824.7600 857.1600 881.0400 904.5600 925.3200 944.0400
##  [801] 952.3200 968.2800 984.0000 991.2360 517.8960 548.0280 577.5120 619.5480
##  [809] 678.3360 733.6080 764.8680 790.4280 816.1800 837.2640 855.1560 870.4200
##  [817] 507.2400 536.2320 575.3880 607.8480 642.7080 673.8600 705.1920 712.0680
##  [825] 711.4200 652.8840 611.9040 649.3200 600.6720 648.9720 679.8720 719.3040
##  [833] 767.7960 805.9080 829.2000 847.7640 839.7360 812.7240 799.9440 807.5640
##  [841] 569.4360 632.1720 663.5040 692.5920 751.3440 777.1920 805.4760 837.7200
##  [849] 866.9280 895.7640 924.5400 943.4760 666.7800 696.3960 725.6400 775.4880
##  [857] 812.5440 832.1160 855.7080 890.0880 902.2800 913.8720 922.8480 931.0560
##  [865] 671.1360 713.8680 745.1280 766.4400 785.0520 793.1880 803.7960 815.1120
##  [873] 831.5040 843.1800 852.3360 863.9160 505.6560 540.5640 572.9640 581.9040
##  [881] 597.2040 626.4960 660.9360 686.1600 716.2200 666.6960 535.1160 511.1040
##  [889] 461.7600 473.8320 486.0240 498.4320 511.3680 525.1680 538.2240 552.3240
##  [897] 489.6240 506.6520 525.0360 548.1360 512.6760 543.4680 573.6960 602.7240
##  [905] 633.2760 689.3040 745.8600 794.8080 825.0600 858.6600 872.8440 887.4240
##  [913] 440.1720 466.3800 490.1760 514.5720 538.2120 562.5720 587.6280 592.2000
##  [921] 626.5680 659.7360 687.4320 713.3160 435.0720 446.4840 460.9200 473.8440
##  [929] 501.1920 525.2040 547.7040 569.4840 593.0400 569.9400 540.1080 579.6360
##  [937] 581.5560 625.2240 668.8440 712.4520 756.1200 783.0720 816.0000 834.0000
##  [945] 848.3160 863.2560 876.5280 890.8920 404.2200 423.6840 443.2320 461.8440
##  [953] 479.7240 500.5680 526.9920 556.3680 580.6560 598.8360 621.8160 653.6040
##  [961] 486.5160 508.0560 530.9760 555.4680 581.2440 610.2240 643.1880 673.7400
##  [969] 699.9960 725.1600 746.9640 769.9680 611.8320 697.0680 722.9520 738.6840
##  [977] 755.3280 779.1600 800.5320 824.8800 836.9400 848.8320 863.4480 873.6120
##  [985] 609.4680 662.2800 699.5880 721.3200 748.3320 780.3840 808.8600 833.9760
##  [993] 857.4600 884.0400 898.8240 914.3400 506.9280 542.9760 579.0120 615.0360
## [1001] 645.0480 665.8920 689.8680 722.6640 735.2520 763.5000 780.3960 801.6360
## [1009] 709.9680 737.3760 764.7360 806.1360 847.6320 876.7920 889.2120 898.3800
## [1017] 905.2200 905.3400 887.7720 894.5160 514.4760 545.0760 575.0880 604.0200
## [1025] 634.3440 668.7600 715.8000 752.1240 784.7160 811.9200 835.3800 853.9680
## [1033] 375.4320 405.3480 433.9320 457.3560 483.9360 509.9400 513.5400 514.3320
## [1041] 531.4080 556.1280 528.3120 504.9840 435.8280 502.8600 541.2960 592.5480
## [1049] 636.8400 672.7080 696.6720 700.0680 711.8400 723.9360 718.8960 744.8280
## [1057] 500.7000 542.7120 580.6320 613.9080 646.4040 677.2440 707.6160 730.0200
## [1065] 743.9880 706.9080 617.7480 634.8720 433.8840 452.2320 472.7160 497.6640
## [1073] 527.6520 560.9760 595.1280 630.4440 668.7240 713.1120 736.0800 765.4200
## [1081] 865.5600 875.8800 878.7600 885.8400 885.0000 902.8800 912.6000 921.9600
## [1089] 929.0400 936.3600 942.3600 957.1440 832.6800 843.1200 854.8800 858.2400
## [1097] 862.6800 866.6400 886.0800 891.8400 915.9600 930.6000 949.3200 962.4480
## [1105] 507.7680 545.1840 583.5840 622.6080 661.8120 689.6400 711.5760 744.0960
## [1113] 790.1160 821.1120 850.0320 874.7880 449.3280 463.1760 473.8440 481.4160
## [1121] 486.5520 495.4920 511.1760 534.6600 568.6920 615.7560 653.9520 682.4040
## [1129] 435.8880 453.6240 472.3200 492.4800 513.8520 534.1680 549.9120 562.6320
## [1137] 569.6640 569.5680 559.2960 562.3080 872.0400 881.2800 881.6400 888.9600
## [1145] 892.0800 904.4400 911.6400 910.6800 927.8400 939.8400 948.6000 962.3520
## [1153] 450.9360 480.9600 517.9800 563.8560 625.7160 688.4040 752.7360 812.8080
## [1161] 854.3640 869.9880 890.3160 907.6800 521.2320 546.6840 572.0400 597.6000
## [1169] 623.1480 648.5160 673.8960 698.9400 730.0560 741.8160 763.3200 785.7960
## [1177] 662.2920 710.4120 741.8040 768.8520 794.5920 824.1720 845.6640 858.2760
## [1185] 869.5440 884.8560 896.5440 906.4440 751.7880 758.3520 772.3320 779.4120
## [1193] 789.7800 796.2360 802.4880 808.5360 818.7000 832.8000 849.0600 861.0240
## [1201] 526.8240 555.1560 589.1520 617.3400 665.3760 701.3640 736.8720 769.6080
## [1209] 797.4960 820.6320 838.8720 857.0520 573.0240 616.0080 657.0840 676.7160
## [1217] 696.7800 720.7200 744.9840 769.8120 797.4960 822.7680 843.6360 860.2560
```

```
## [1225] 735.7200 789.2400 811.6800 835.3200 850.2000 848.0400 855.8400 851.7600
## [1233] 851.8800 873.0000 896.0400 906.7560 717.8400 738.1200 772.6800 799.2000
## [1241] 831.1200 844.9200 873.2400 888.7200 898.3200 911.6400 927.4800 937.1760
## [1249] 771.3600 822.4800 835.4400 853.2000 865.9200 881.2800 885.0000 895.5600
## [1257] 886.9320 899.0040 933.3360 944.9520 632.6880 661.0800 691.9920 726.5040
## [1265] 771.2880 804.7680 838.6200 862.9560 883.3800 897.2640 908.9280 917.3040
## [1273] 732.6000 769.2000 801.6000 801.6000 830.5200 833.5200 835.9200 834.3600
## [1281] 832.3200 836.6400 855.8640 869.7120 480.0000 498.0000 516.0000 529.2000
## [1289] 535.2000 540.0000 554.6160 528.2400 283.1880 433.0440 520.9560 554.9040
## [1297] 557.6520 587.3400 622.7160 653.1000 677.7600 702.6000 724.2120 740.7360
## [1305] 752.9040 759.6720 772.0440 786.3360 478.5000 514.4160 550.9680 598.8120
## [1313] 646.6320 704.2800 756.1440 795.5400 825.2160 846.3960 859.5120 873.3240
## [1321] 447.3360 471.9480 497.4480 522.7560 549.7800 586.5480 628.5480 669.2280
## [1329] 698.3520 722.2440 739.2000 756.7440 695.9520 740.2200 774.3720 802.9680
## [1337] 824.4000 843.6000 841.9440 854.6160 859.9080 866.7840 878.5560 888.0240
## [1345] 363.9720 378.8400 393.2040 409.3560 424.8000 441.4560 461.3400 480.0720
## [1353] 459.9960 478.7640 492.1440 510.8160 724.7520 758.1480 789.5760 815.3520
## [1361] 834.2520 849.5400 861.1200 882.7200 909.4560 925.8960 945.2400 959.6640
## [1369] 772.3200 809.4000 843.9600 851.7600 844.2000 845.4000 849.6000 852.9600
## [1377] 856.5600 872.5200 885.6000 895.9560 786.8400 814.2000 829.8000 830.1600
## [1385] 837.8400 851.6400 852.7560 867.0000 883.6800 901.5600 919.9200 935.1120
## [1393] 395.7360 419.7240 443.7720 467.7240 491.6760 503.6880 515.4600 534.0120
## [1401] 475.8960 525.5400 551.2320 577.9080 540.1080 575.8200 599.4120 623.1240
## [1409] 644.3520 666.3240 697.9320 730.0080 742.6560 722.8320 640.3800 592.0680
## [1417] 779.2800 799.9200 836.2800 857.2800 876.7200 892.6800 915.6000 922.8000
## [1425] 930.8400 945.2400 957.3600 971.2920 691.1160 737.4720 746.3040 771.1920
## [1433] 780.5040 791.3880 825.0840 828.1320 844.5480 845.4840 849.7800 868.7520
## [1441] 463.6200 475.4880 490.4400 514.2960 540.9960 573.6000 604.0560 620.9280
## [1449] 642.6720 664.4760 676.4280 702.6720 496.8840 521.0880 539.9040 559.5960
## [1457] 594.6240 630.4440 666.7320 692.1360 701.6880 651.4680 526.4280 475.3560
## [1465] 862.3200 869.8800 880.4400 889.9200 896.6400 905.2800 917.0400 926.2800
## [1473] 937.9200 952.6800 960.4800 970.6080 835.4400 846.7200 855.8400 873.2400
## [1481] 885.3600 904.6800 914.5200 928.9200 936.3600 952.4400 967.4400 980.4120
## [1489] 550.5960 579.4080 603.6600 643.8600 687.5520 734.3400 775.0800 803.6880
## [1497] 830.9880 858.3240 876.6360 889.7160 702.0000 748.8000 782.4000 810.0000
## [1505] 832.6800 847.0800 865.9200 880.8000 891.1200 903.0000 923.8800 940.8000
## [1513] 494.5800 515.6880 530.9520 549.0840 571.4400 599.0280 607.2960 618.4200
## [1521] 605.2800 581.5920 595.8120 630.2040 610.1760 643.5600 672.7320 699.4200
## [1529] 724.8600 749.9280 775.1640 793.0080 807.5760 810.2520 822.7680 847.3920
## [1537] 463.1520 494.4960 527.0640 561.2280 597.1080 634.6440 665.6520 683.2920
## [1545] 696.7320 700.6800 690.7320 701.0400 709.2000 741.6000 778.8000 784.8000
## [1553] 790.8000 819.6000 825.9840 834.9840 838.3440 833.5800 827.7120 837.8280
## [1561] 535.2000 565.2000 594.9480 624.6360 667.2240 718.0440 768.5760 802.7280
## [1569] 840.0120 863.6760 876.5040 887.0760 523.0200 576.9480 625.1760 652.0320
## [1577] 684.0600 714.0840 732.4320 757.2960 793.7520 826.0200 850.1400 861.3240
## [1585] 479.7360 510.8520 544.1280 576.6120 612.1920 604.2000 598.1880 618.1080
## [1593] 585.9000 534.9360 573.7560 618.5040 830.1600 845.0400 849.1200 856.3200
## [1601] 864.1200 873.1200 888.4800 900.0840 917.0400 926.6160 941.6520 953.1000
## [1609] 821.2800 833.8800 842.5200 849.1200 856.0800 880.5600 895.8000 900.2400
## [1617] 913.0800 921.7200 927.7200 938.9040 792.8520 804.5280 819.0360 821.6160
## [1625] 824.0760 833.7720 849.6600 863.0160 873.0240 890.6760 903.6840 916.6080
## [1633] 661.0560 694.8840 729.2400 761.7480 788.5440 809.4720 822.6840 842.2800
## [1641] 853.8000 865.7520 873.1920 884.9640 484.9440 514.6440 544.3560 574.0560
## [1649] 603.0480 669.1680 705.7920 753.8400 811.9440 848.0640 876.2040 890.9880
```

```
## [1657] 517.9200 548.0520 577.5240 619.5720 678.3840 729.1800 772.8720 804.5520
## [1665] 836.6160 853.1520 868.4400 881.0640 390.5760 407.6400 422.1600 443.8080
## [1673] 478.1760 530.1000 589.3560 635.0640 667.1880 696.2400 723.6960 752.3760
## [1681] 504.4560 528.9240 552.2760 573.2160 601.2840 616.6320 621.8520 609.8520
## [1689] 553.2000 482.8560 470.3160 508.6080 581.4120 605.6280 628.2960 647.9400
## [1697] 667.6200 692.0880 724.3560 748.2120 724.5240 561.7080 479.8680 521.8440
```

Using another `for` command, create a new variable that is the log value of `lifeExp_months`. Call this variable `log_lifeExp_months`.

```
for(i in obs){
  gapminder[i, "log_lifeExp_months"]<- log(gapminder[i,"lifeExp_months"])
}
gapminder$log_lifeExp_months
```

```
##     [1] 5.845317 5.897110 5.950549 6.011855 6.070867 6.133953 6.170129 6.194128
##     [9] 6.214784 6.216917 6.225643 6.265180 6.496413 6.567179 6.656521 6.677889
##    [17] 6.699845 6.717998 6.739384 6.761573 6.755736 6.774681 6.811037 6.821190
##    [25] 6.247896 6.306677 6.362400 6.424681 6.483438 6.545591 6.601795 6.671511
##    [33] 6.700643 6.721214 6.747502 6.765745 5.886604 5.950611 6.011267 6.068009
##    [41] 6.120596 6.160777 6.172335 6.171433 6.189832 6.197576 6.198552 6.239831
##    [49] 6.619833 6.650005 6.661476 6.669001 6.690569 6.711463 6.732573 6.744398
##    [57] 6.759738 6.779126 6.793556 6.806652 6.720751 6.738105 6.746600 6.748994
##    [65] 6.760600 6.782056 6.798922 6.819842 6.835958 6.852200 6.871548 6.882253
##    [73] 6.686610 6.696738 6.726809 6.735400 6.742362 6.763931 6.777829 6.801594
##    [81] 6.816166 6.835314 6.854101 6.864793 6.415535 6.470775 6.526606 6.577967
##    [89] 6.632792 6.668376 6.719766 6.744059 6.769885 6.787958 6.799658 6.810826
##    [97] 6.108821 6.157352 6.203733 6.256587 6.297154 6.333415 6.397110 6.451778
##   [105] 6.510580 6.569403 6.612251 6.644758 6.704414 6.722485 6.736967 6.746741
##   [113] 6.753765 6.772623 6.788025 6.807051 6.821674 6.835572 6.845710 6.859921
##   [121] 6.128344 6.182696 6.237183 6.289010 6.335352 6.380597 6.414848 6.442610
##   [129] 6.472390 6.488177 6.481381 6.523175 6.184083 6.219954 6.256011 6.292280
##   [137] 6.328951 6.397390 6.471276 6.532352 6.578534 6.612847 6.641960 6.667781
##   [145] 6.470552 6.553078 6.610911 6.656058 6.696293 6.731400 6.743211 6.749556
##   [153] 6.764042 6.778703 6.790187 6.800419 6.348201 6.389260 6.426877 6.460805
##   [161] 6.510687 6.567836 6.603684 6.637866 6.623986 6.446786 6.327237 6.411385
##   [169] 6.415104 6.460562 6.504258 6.538985 6.570950 6.603765 6.633361 6.662443
##   [177] 6.690450 6.724621 6.747671 6.766975 6.572562 6.683761 6.726377 6.739384
##   [185] 6.746177 6.744907 6.748713 6.752364 6.750259 6.737963 6.763515 6.775435
##   [193] 5.949861 6.037565 6.117586 6.191061 6.259757 6.316522 6.358646 6.388030
##   [201] 6.402116 6.403389 6.409846 6.441807 6.149263 6.187023 6.223647 6.258770
##   [209] 6.270391 6.311590 6.345026 6.360494 6.285685 6.298787 6.342685 6.388494
##   [217] 6.159104 6.207366 6.255712 6.300749 6.181680 5.925966 6.415889 6.472297
##   [225] 6.506734 6.519749 6.523598 6.574624 6.136162 6.184429 6.237770 6.287092
##   [233] 6.336096 6.383946 6.454462 6.491967 6.479689 6.439970 6.394046 6.405493
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##   [249] 6.840974 6.849406 6.864054 6.875063 6.053397 6.108287 6.160574 6.210070
##   [257] 6.256679 6.330256 6.362235 6.406583 6.384776 6.314982 6.253244 6.285797
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##   [273] 6.430829 6.427905 6.407375 6.409866 6.487593 6.511579 6.544038 6.587930
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##   [289] 6.269096 6.407849 6.280426 6.551899 6.629927 6.643280 6.667338 6.693680
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##   [305] 6.605942 6.641240 6.684407 6.700997 6.710586 6.737863 6.757146 6.773844
##   [313] 6.191503 6.233469 6.279654 6.323757 6.375583 6.415535 6.453934 6.490893
```

```
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## [345] 6.517961 6.454481 6.454632 6.498077 6.531565 6.579684 6.625530 6.665796
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## [665] 6.761573 6.783552 6.808377 6.818268 6.836487 6.866933 6.885448 6.894159
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## [745] 6.688255 6.717563 6.737536 6.748713 6.751522 6.761989 6.776735 6.793825
```

```
##  [753] 6.808602 6.817244 6.838830 6.852898 6.665276 6.702059 6.724649 6.744059
##  [761] 6.756421 6.776188 6.795034 6.810363 6.827803 6.845058 6.863126 6.876203
##  [769] 6.673652 6.701616 6.722485 6.748431 6.764208 6.781920 6.802128 6.821151
##  [777] 6.834410 6.852073 6.869929 6.873735 6.554446 6.621832 6.668635 6.697182
##  [785] 6.719013 6.734972 6.750540 6.758373 6.758317 6.765205 6.762225 6.769417
##  [793] 6.628517 6.666957 6.715092 6.753625 6.781103 6.807449 6.830140 6.850169
##  [801] 6.858901 6.875521 6.891626 6.898953 6.249774 6.306326 6.358729 6.428990
##  [809] 6.519643 6.597975 6.639703 6.672575 6.704635 6.730139 6.751284 6.768976
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##  [825] 6.567263 6.481399 6.416575 6.475926 6.398049 6.475390 6.521905 6.578284
##  [833] 6.643524 6.691970 6.720461 6.742602 6.733088 6.700392 6.684542 6.694022
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## [1089] 6.834152 6.842000 6.848387 6.863954 6.724649 6.737109 6.750961 6.754884
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## [1137] 6.345047 6.344878 6.326679 6.332050 6.770835 6.781375 6.781784 6.790052
## [1145] 6.793556 6.807316 6.815245 6.814192 6.832859 6.845710 6.854987 6.869380
## [1153] 6.111325 6.175784 6.249937 6.334799 6.438897 6.534376 6.623715 6.700495
## [1161] 6.750357 6.768479 6.791576 6.810892 6.256195 6.303871 6.349209 6.392922
## [1169] 6.434784 6.474687 6.513076 6.549565 6.593121 6.609101 6.637677 6.666697
## [1177] 6.495707 6.565845 6.609085 6.644898 6.677829 6.714379 6.740122 6.754926
```

```
## [1185] 6.767969 6.785425 6.798547 6.809529 6.622454 6.631148 6.649415 6.658540
## [1193] 6.671754 6.679896 6.687717 6.695225 6.707718 6.724794 6.744130 6.758122
## [1201] 6.266867 6.319249 6.378684 6.425420 6.500352 6.553027 6.602414 6.645881
## [1209] 6.681477 6.710075 6.732058 6.753499 6.350928 6.423260 6.487812 6.517252
## [1217] 6.546470 6.580251 6.613363 6.646146 6.681477 6.712674 6.737721 6.757230
## [1225] 6.600850 6.671070 6.699106 6.727815 6.745472 6.742928 6.752083 6.747305
## [1233] 6.747446 6.771936 6.797985 6.809873 6.576247 6.604106 6.649865 6.683611
## [1241] 6.722774 6.739242 6.772210 6.789782 6.800526 6.815245 6.832471 6.842871
## [1249] 6.648155 6.712324 6.727959 6.748994 6.763793 6.781375 6.785588 6.797449
## [1257] 6.787768 6.801287 6.838765 6.851134 6.449977 6.493875 6.539574 6.588244
## [1265] 6.648062 6.690554 6.731758 6.760364 6.783755 6.799350 6.812266 6.821439
## [1273] 6.596600 6.645351 6.686610 6.686610 6.722052 6.725658 6.728533 6.726665
## [1281] 6.724217 6.729394 6.752111 6.768162 6.173786 6.210600 6.246107 6.271366
## [1289] 6.282641 6.291569 6.318276 6.269551 5.646111 6.070839 6.255666 6.318795
## [1297] 6.323735 6.375604 6.434091 6.481730 6.518793 6.554788 6.585084 6.607644
## [1305] 6.623938 6.632887 6.649042 6.667384 6.170656 6.243032 6.311677 6.394948
## [1313] 6.471777 6.557176 6.628232 6.679021 6.715645 6.740987 6.756365 6.772307
## [1321] 6.103310 6.156869 6.209491 6.259115 6.309518 6.374255 6.443412 6.506125
## [1329] 6.548723 6.582363 6.605569 6.629025 6.545281 6.606947 6.652052 6.688315
## [1337] 6.714656 6.737678 6.735714 6.750652 6.756825 6.764790 6.778280 6.788999
## [1345] 5.897077 5.937114 5.974329 6.014585 6.051618 6.090078 6.134135 6.173936
## [1353] 6.131218 6.171208 6.198771 6.236009 6.585830 6.630879 6.671496 6.703620
## [1361] 6.726536 6.744695 6.758234 6.783008 6.812847 6.830762 6.851439 6.866583
## [1369] 6.649399 6.696293 6.738105 6.747305 6.738389 6.739810 6.744766 6.748713
## [1377] 6.752924 6.771386 6.786265 6.797891 6.668025 6.702206 6.721185 6.721618
## [1385] 6.730827 6.747164 6.748473 6.765039 6.784095 6.804127 6.824287 6.840666
## [1393] 5.980747 6.039597 6.095311 6.147878 6.197820 6.221957 6.245060 6.280418
## [1401] 6.165199 6.264426 6.312156 6.359415 6.291769 6.355795 6.395949 6.434746
## [1409] 6.468245 6.501776 6.548122 6.593055 6.610233 6.583177 6.462062 6.383621
## [1417] 6.658370 6.684512 6.728963 6.753765 6.776188 6.794228 6.819580 6.827413
## [1425] 6.836087 6.851439 6.864179 6.878627 6.538308 6.603228 6.615133 6.647937
## [1433] 6.659940 6.673788 6.715485 6.719173 6.738802 6.739909 6.744977 6.767058
## [1441] 6.139065 6.164342 6.195303 6.242799 6.293412 6.351932 6.403667 6.431215
## [1449] 6.465634 6.498999 6.516826 6.554890 6.208357 6.255919 6.291391 6.327215
## [1457] 6.387929 6.446424 6.502388 6.539782 6.553489 6.479228 6.266115 6.164064
## [1465] 6.759626 6.768355 6.780422 6.791132 6.798654 6.808244 6.821151 6.831177
## [1473] 6.843665 6.859279 6.867433 6.877923 6.727959 6.741370 6.752083 6.772210
## [1481] 6.785994 6.807581 6.818399 6.834023 6.842000 6.859027 6.874653 6.887973
## [1489] 6.311001 6.362007 6.403011 6.467481 6.533137 6.598972 6.652966 6.689211
## [1497] 6.722615 6.754982 6.776092 6.790902 6.553933 6.618472 6.662366 6.697034
## [1505] 6.724649 6.741795 6.763793 6.780831 6.792479 6.805723 6.828582 6.846731
## [1513] 6.203709 6.245502 6.274672 6.308251 6.348159 6.395308 6.409016 6.427168
## [1521] 6.405691 6.365769 6.389925 6.446044 6.413747 6.467015 6.511347 6.550251
## [1529] 6.585979 6.619977 6.653075 6.675833 6.694037 6.697345 6.712674 6.742163
## [1537] 6.138055 6.203539 6.267322 6.330127 6.392098 6.453064 6.500767 6.526922
## [1545] 6.546401 6.552051 6.537752 6.552565 6.564138 6.608810 6.657754 6.665429
## [1553] 6.673045 6.708816 6.716575 6.727413 6.731429 6.725730 6.718665 6.730813
## [1561] 6.282641 6.337180 6.388474 6.437169 6.503126 6.576531 6.644539 6.688016
## [1569] 6.733416 6.761198 6.775941 6.787931 6.259620 6.357752 6.438033 6.480094
## [1577] 6.528046 6.571001 6.596371 6.629754 6.676771 6.716619 6.745401 6.758471
## [1585] 6.173236 6.236080 6.299185 6.357170 6.417046 6.403905 6.393905 6.426663
## [1593] 6.373149 6.282147 6.352204 6.427304 6.721618 6.739384 6.744201 6.752644
## [1601] 6.761712 6.772073 6.789512 6.802488 6.821151 6.831539 6.847636 6.859720
## [1609] 6.710864 6.726090 6.736397 6.744201 6.752364 6.780558 6.797717 6.802661
```

```
## [1617] 6.816823 6.826241 6.832730 6.844713 6.675637 6.690256 6.708128 6.711273
## [1625] 6.714263 6.725960 6.744836 6.760433 6.771963 6.791981 6.806480 6.820680
## [1633] 6.493839 6.543745 6.592003 6.635616 6.670188 6.696382 6.712572 6.736113
## [1641] 6.749697 6.763598 6.772155 6.785547 6.184033 6.243475 6.299603 6.352727
## [1649] 6.401997 6.506035 6.559321 6.625180 6.699431 6.742956 6.775599 6.792331
## [1657] 6.249821 6.306370 6.358750 6.429029 6.519713 6.591921 6.650113 6.690286
## [1665] 6.729365 6.748938 6.766698 6.781130 5.967623 6.010384 6.045384 6.095392
## [1673] 6.169979 6.273066 6.379030 6.453726 6.503072 6.545694 6.584371 6.623236
## [1681] 6.223481 6.270845 6.314048 6.351263 6.399067 6.424272 6.432702 6.413216
## [1689] 6.315720 6.179718 6.153405 6.231678 6.365460 6.406266 6.443011 6.473798
## [1697] 6.503719 6.539713 6.585283 6.617686 6.585515 6.330982 6.173511 6.257369
```

Use the vectorized method to replicate both of these variables without a loop. Call them lifeExp_months_2 and log_lifeExp_months_2, respectively. Compare these to the looped method.

```
gapminder$lifeExpmonths_2<-gapminder$lifeExp*12

gapminder$log_lifeExp_months_2<-log(gapminder$lifeExp*12)
#or
gapminder$log_lifeExp_months_2<-log(gapminder$lifeExpmonths_2)

all(gapminder$lifeExp_months== gapminder$lifeExpmonths_2)
```

```
## [1] TRUE
```

```
all(gapminder$log_lifeExp_months== gapminder$log_lifeExpmonths_2)
```

```
## [1] TRUE
```

Using a method of your choosing, use the gdpPercap variable and pop variable to calculate the GDP per year per country. Call this variable "gdp".

```
for (i in obs) {
  gapminder[i, "gdp"]<- gapminder[i, "pop"]*gapminder[i, "gdpPercap"]
}

#or

gapminder$gdp<-gapminder$pop*gapminder$gdpPercap
```

Now account for each of the unique country names that are in the dataset, and create a variable with them called "countries"

```
countries<-unique(gapminder$country)
```

Create a nested loop in which you create a readout of the country name and a calculation of the average log gdp for all years accounted for in the dataset.

Repeat this for the standard deviation of country log gdp's over time.

```
for (i in countries){
  mean_gdp<-mean(log(gapminder$gdp)[gapminder$country==i],
                 na.rm = T)
  print(paste0(i, ": ", mean_gdp))
}
```

```
## [1] "Afghanistan: 23.1760144117578"
## [1] "Albania: 22.7370077327398"
## [1] "Algeria: 25.0620488890838"
```

```
## [1] "Angola: 23.8900068088738"
## [1] "Argentina: 26.2159009465398"
## [1] "Australia: 26.295676609644"
## [1] "Austria: 25.6383894330615"
## [1] "Bahrain: 22.42519326821"
## [1] "Bangladesh: 24.928828607845"
## [1] "Belgium: 25.8952768349448"
## [1] "Benin: 22.1270107181762"
## [1] "Bolivia: 23.4528408469819"
## [1] "Bosnia and Herzegovina: 23.1425438582745"
## [1] "Botswana: 21.7807284816314"
## [1] "Brazil: 27.1178529460078"
## [1] "Bulgaria: 24.6003783256026"
## [1] "Burkina Faso: 22.4773628186682"
## [1] "Burundi: 21.4161561362174"
## [1] "Cambodia: 22.3245501522449"
## [1] "Cameroon: 23.4664866854896"
## [1] "Canada: 26.9348585427303"
## [1] "Central African Republic: 21.5204779454799"
## [1] "Chad: 22.4397697588331"
## [1] "Chile: 24.9195271811255"
## [1] "China: 27.6328874585942"
## [1] "Colombia: 25.3119050704862"
## [1] "Comoros: 19.8402355427784"
## [1] "Congo Dem. Rep.: 23.5611837897379"
## [1] "Congo Rep.: 22.4306370651027"
## [1] "Costa Rica: 23.1224788341156"
## [1] "Cote d'Ivoire: 23.3911258261585"
## [1] "Croatia: 24.3162131318882"
## [1] "Cuba: 24.7501561410022"
## [1] "Czech Republic: 25.608153327611"
## [1] "Denmark: 25.3302347264122"
## [1] "Djibouti: 20.1342757616933"
## [1] "Dominican Republic: 23.3363572223655"
## [1] "Ecuador: 24.4494855327827"
## [1] "Egypt: 25.4981191510575"
## [1] "El Salvador: 23.5982195350404"
## [1] "Equatorial Guinea: 19.7770338194188"
## [1] "Eritrea: 21.0210975386163"
## [1] "Ethiopia: 23.6720576815794"
## [1] "Finland: 25.0272814853263"
## [1] "France: 27.525006157815"
## [1] "Gabon: 22.7520168664596"
## [1] "Gambia: 19.9307996612118"
## [1] "Germany: 28.0077074423866"
## [1] "Ghana: 23.194763457591"
## [1] "Greece: 25.4373570838164"
## [1] "Guatemala: 23.9159490361892"
## [1] "Guinea: 22.0358348147248"
## [1] "Guinea-Bissau: 20.0771503809376"
## [1] "Haiti: 22.8366666040036"
## [1] "Honduras: 22.9967884984804"
## [1] "Hong Kong China: 24.6988630483231"
## [1] "Hungary: 25.3791325427051"
```

```
## [1] "Iceland: 22.1265181036359"
## [1] "India: 27.161796596954"
## [1] "Indonesia: 26.0741407225105"
## [1] "Iran: 26.2712383752933"
## [1] "Iraq: 25.1694805733227"
## [1] "Ireland: 24.4579633753766"
## [1] "Israel: 24.4946525984781"
## [1] "Italy: 27.3657617832273"
## [1] "Jamaica: 23.2563272411791"
## [1] "Japan: 28.084054035341"
## [1] "Jordan: 22.5364901788116"
## [1] "Kenya: 23.6430808551617"
## [1] "Korea Dem. Rep.: 24.3182589540954"
## [1] "Korea Rep.: 25.9048302015036"
## [1] "Kuwait: 24.6580324653716"
## [1] "Lebanon: 23.6577551058416"
## [1] "Lesotho: 20.615753489358"
## [1] "Liberia: 20.7271674396013"
## [1] "Libya: 24.0261093140048"
## [1] "Madagascar: 23.1809108504615"
## [1] "Malawi: 21.9704394985958"
## [1] "Malaysia: 24.7809985584573"
## [1] "Mali: 22.1961634936247"
## [1] "Mauritania: 21.5040275190199"
## [1] "Mauritius: 22.0083931003847"
## [1] "Mexico: 26.8439319438552"
## [1] "Mongolia: 21.6394772237473"
## [1] "Montenegro: 22.0283905628576"
## [1] "Morocco: 24.5272152205558"
## [1] "Mozambique: 22.5132457129521"
## [1] "Myanmar: 23.3197130298516"
## [1] "Namibia: 22.0409940290634"
## [1] "Nepal: 23.1876332538481"
## [1] "Netherlands: 26.3309659490209"
## [1] "New Zealand: 24.6508467880618"
## [1] "Nicaragua: 22.9016309543016"
## [1] "Niger: 22.2887046951961"
## [1] "Nigeria: 25.2962006662115"
## [1] "Norway: 25.2723900019445"
## [1] "Oman: 23.0944280867625"
## [1] "Pakistan: 25.4340004707013"
## [1] "Panama: 23.0121756769451"
## [1] "Paraguay: 23.0178851826933"
## [1] "Peru: 25.2158249112542"
## [1] "Philippines: 25.3392469178519"
## [1] "Poland: 26.3140721075136"
## [1] "Portugal: 25.2375638500159"
## [1] "Puerto Rico: 24.0739830301705"
## [1] "Reunion: 21.5517046201593"
## [1] "Romania: 25.6803133657072"
## [1] "Rwanda: 21.8945901003332"
## [1] "Sao Tome and Principe: 18.696438662588"
## [1] "Saudi Arabia: 25.9302361670226"
## [1] "Senegal: 22.8963825412535"
```

```
## [1] "Serbia: 25.0342961628434"
## [1] "Sierra Leone: 21.9867171091246"
## [1] "Singapore: 24.0547750608776"
## [1] "Slovak Republic: 24.5641123210641"
## [1] "Slovenia: 23.8251021540712"
## [1] "Somalia: 22.4068216761293"
## [1] "South Africa: 26.0133576108276"
## [1] "Spain: 26.7568136464685"
## [1] "Sri Lanka: 23.8759451073712"
## [1] "Sudan: 24.2580114511116"
## [1] "Swaziland: 21.2905048035937"
## [1] "Sweden: 25.7424478264338"
## [1] "Switzerland: 25.8331902803571"
## [1] "Syria: 23.9262281682553"
## [1] "Taiwan: 25.3311314424438"
## [1] "Tanzania: 23.4540843453234"
## [1] "Thailand: 25.2936094838149"
## [1] "Togo: 21.781133988153"
## [1] "Trinidad and Tobago: 22.6758116790548"
## [1] "Tunisia: 23.6793002370759"
## [1] "Turkey: 25.8798224121868"
## [1] "Uganda: 23.0401352005367"
## [1] "United Kingdom: 27.6461800115209"
## [1] "United States: 29.3379643791321"
## [1] "Uruguay: 23.7229952101315"
## [1] "Venezuela: 25.6261468926776"
## [1] "Vietnam: 24.5626350175345"
## [1] "West Bank and Gaza: 22.4436305000512"
## [1] "Yemen Rep.: 23.359400267014"
## [1] "Zambia: 22.7498267322517"
## [1] "Zimbabwe: 22.1811143618457"
```

```r
for (i in countries){
  sd_gdp<- sd(log(gapminder$gdp)[gapminder$country==i],
              na.rm = T)
  print(paste0(i, ": ", sd_gdp))
}
```

```
## [1] "Afghanistan: 0.41409132432232"
## [1] "Albania: 0.689847360156763"
## [1] "Algeria: 0.765357816222069"
## [1] "Angola: 0.372050803128703"
## [1] "Argentina: 0.464464222349373"
## [1] "Australia: 0.680066069840277"
## [1] "Austria: 0.611716756799869"
## [1] "Bahrain: 0.91741516284081"
## [1] "Bangladesh: 0.614276094147324"
## [1] "Belgium: 0.518010787967105"
## [1] "Benin: 0.642240518517432"
## [1] "Bolivia: 0.540291291688552"
## [1] "Bosnia and Herzegovina: 0.747130997693171"
## [1] "Botswana: 1.52776668339425"
## [1] "Brazil: 0.907746033586554"
## [1] "Bulgaria: 0.471258714258"
## [1] "Burkina Faso: 0.602436885753479"
```

```
## [1] "Burundi: 0.535379008484598"
## [1] "Cambodia: 0.739663711786716"
## [1] "Cameroon: 0.624274741604704"
## [1] "Canada: 0.642441913580752"
## [1] "Central African Republic: 0.240251775710326"
## [1] "Chad: 0.48887615626477"
## [1] "Chile: 0.692585055162484"
## [1] "China: 1.07230611274621"
## [1] "Colombia: 0.825626200197794"
## [1] "Comoros: 0.459133090311848"
## [1] "Congo Dem. Rep.: 0.22597423703403"
## [1] "Congo Rep.: 0.706930462858404"
## [1] "Costa Rica: 0.876124237734943"
## [1] "Cote d'Ivoire: 0.694720298773607"
## [1] "Croatia: 0.536229699135298"
## [1] "Cuba: 0.329240017213214"
## [1] "Czech Republic: 0.373762039933973"
## [1] "Denmark: 0.48913081343437"
## [1] "Djibouti: 0.641325752834179"
## [1] "Dominican Republic: 0.880988598881027"
## [1] "Ecuador: 0.715581139188156"
## [1] "Egypt: 0.915647217977956"
## [1] "El Salvador: 0.567608856933076"
## [1] "Equatorial Guinea: 1.39681457456336"
## [1] "Eritrea: 0.71219923776832"
## [1] "Ethiopia: 0.580335985983442"
## [1] "Finland: 0.59816238268362"
## [1] "France: 0.602574406331417"
## [1] "Gabon: 0.85533918070767"
## [1] "Gambia: 0.693125378124704"
## [1] "Germany: 0.522758046004197"
## [1] "Ghana: 0.505175053439361"
## [1] "Greece: 0.748097535343643"
## [1] "Guatemala: 0.698310445489643"
## [1] "Guinea: 0.627227464236509"
## [1] "Guinea-Bissau: 0.524083659747746"
## [1] "Haiti: 0.221242940951754"
## [1] "Honduras: 0.678452085247881"
## [1] "Hong Kong China: 1.25831435671648"
## [1] "Hungary: 0.379187252773389"
## [1] "Iceland: 0.744032622148468"
## [1] "India: 0.82390204415352"
## [1] "Indonesia: 0.911654232535794"
## [1] "Iran: 0.899712785961866"
## [1] "Iraq: 0.661541092256282"
## [1] "Ireland: 0.805054444278644"
## [1] "Israel: 1.0346317047866"
## [1] "Italy: 0.653486913572524"
## [1] "Jamaica: 0.465870146004671"
## [1] "Japan: 0.919094122730394"
## [1] "Jordan: 1.10436472235577"
## [1] "Kenya: 0.758374035563509"
## [1] "Korea Dem. Rep.: 0.697225576795484"
## [1] "Korea Rep.: 1.37456269678867"
```

```
## [1] "Kuwait: 0.546836927109139"
## [1] "Lebanon: 0.542428922949497"
## [1] "Lesotho: 0.903687062551853"
## [1] "Liberia: 0.34446100309127"
## [1] "Libya: 1.1275965518126"
## [1] "Madagascar: 0.279527305311343"
## [1] "Malawi: 0.73830426875944"
## [1] "Malaysia: 1.13573659579445"
## [1] "Mali: 0.624875125115895"
## [1] "Mauritania: 0.614374169620826"
## [1] "Mauritius: 0.857379653789938"
## [1] "Mexico: 0.834398635291916"
## [1] "Mongolia: 0.841961920812373"
## [1] "Montenegro: 0.577308382136609"
## [1] "Morocco: 0.701706090617244"
## [1] "Mozambique: 0.478716325501544"
## [1] "Myanmar: 0.549242358414971"
## [1] "Namibia: 0.675877215486887"
## [1] "Nepal: 0.62187541083623"
## [1] "Netherlands: 0.596441347497806"
## [1] "New Zealand: 0.481384836974366"
## [1] "Nicaragua: 0.439698039505462"
## [1] "Niger: 0.308634161445738"
## [1] "Nigeria: 0.66841787322987"
## [1] "Norway: 0.643386971058801"
## [1] "Oman: 1.53588640395701"
## [1] "Pakistan: 0.928527578918077"
## [1] "Panama: 0.820270052949008"
## [1] "Paraguay: 0.784334743088959"
## [1] "Peru: 0.58494971871467"
## [1] "Philippines: 0.717470842866642"
## [1] "Poland: 0.514402312622994"
## [1] "Portugal: 0.724972562564177"
## [1] "Puerto Rico: 0.816904848132255"
## [1] "Reunion: 0.685123563470303"
## [1] "Romania: 0.486091531674129"
## [1] "Rwanda: 0.616554271774375"
## [1] "Sao Tome and Principe: 0.581300144489683"
## [1] "Saudi Arabia: 1.08554853042155"
## [1] "Senegal: 0.499375453304797"
## [1] "Serbia: 0.53360027194816"
## [1] "Sierra Leone: 0.338702272790099"
## [1] "Singapore: 1.46700977431379"
## [1] "Slovak Republic: 0.491471135605556"
## [1] "Slovenia: 0.657830966241258"
## [1] "Somalia: 0.326820521231964"
## [1] "South Africa: 0.579982609649728"
## [1] "Spain: 0.787141557000844"
## [1] "Sri Lanka: 0.74406756079188"
## [1] "Sudan: 0.606866841190544"
## [1] "Swaziland: 0.941587704721477"
## [1] "Sweden: 0.504837364233549"
## [1] "Switzerland: 0.420793594363936"
## [1] "Syria: 0.87894458070635"
```

```
## [1] "Taiwan: 1.43978601623517"
## [1] "Tanzania: 0.612940938521911"
## [1] "Thailand: 1.18109777941323"
## [1] "Togo: 0.519375696850536"
## [1] "Trinidad and Tobago: 0.620362746807554"
## [1] "Tunisia: 0.908988820731358"
## [1] "Turkey: 0.865440268266583"
## [1] "Uganda: 0.58638635927891"
## [1] "United Kingdom: 0.439771106467074"
## [1] "United States: 0.58430494271208"
## [1] "Uruguay: 0.329418066974955"
## [1] "Venezuela: 0.605538551836138"
## [1] "Vietnam: 0.809174697529872"
## [1] "West Bank and Gaza: 0.861221200530396"
## [1] "Yemen Rep.: 0.915211269015824"
## [1] "Zambia: 0.454041280958691"
## [1] "Zimbabwe: 0.632574254807112"
```

While Loops

Set an interator starting with 1954, use a while loop to calculate the standard deviation of log gdp for ever 3 years before 2002 (inclusive).

Make the read out so that it reads as "Year: standard deviation" (hint: see lecture notes for this particular format)

```r
gapminder$log_gdp<-log(gapminder$gdp)

i<-1954
while (i <= 2002) {
  sd_gdp_post1980<-sd(gapminder$log_gdp[gapminder$year==i], na.rm = T)
  print(paste0(i, ": ", sd_gdp_post1980))
  i<-i+3
}
```

```
## [1] "1954: NA"
## [1] "1957: 1.95340859753036"
## [1] "1960: NA"
## [1] "1963: NA"
## [1] "1966: NA"
## [1] "1969: NA"
## [1] "1972: 1.95798213108418"
## [1] "1975: NA"
## [1] "1978: NA"
## [1] "1981: NA"
## [1] "1984: NA"
## [1] "1987: 1.98610512664019"
## [1] "1990: NA"
## [1] "1993: NA"
## [1] "1996: NA"
## [1] "1999: NA"
## [1] "2002: 1.98897436197728"
```

Conditional Statements

Then create an `if/else` command that prints "Mean gdp per capita is less than 900" if the mean gdp per capita is less than 900 over all observed years. Else, print the statement "Mean GDP per capita is greater than 900."

```r
if(mean(gapminder$gdpPercap) < 900) {
  print(paste("Mean GDP per capita is less than", 900))
} else {
  print(paste("Mean GDP per capita is greater than", 900))
}
```

```
## [1] "Mean GDP per capita is greater than 900"
```

Create a `for` loop with an if/else conditional: Write a `for` loop that calculates the mean gdp per capita for each country over the observed years in the dataset. If a given country's mean gdp per capita is greater than the median for all country-year observations, then print the country and its mean gdp per capita. `Else`, print the country name and the statement "Sorry, this country does not meet the median threshold."

```r
for(i in unique(gapminder$country)) {
  mean_gdpPercap<- mean(gapminder$gdpPercap[gapminder$country==i], na.rm=T)

  if(mean_gdpPercap > median(gapminder$gdpPercap, na.rm=T)){
  print(paste0(i, ": ", mean_gdpPercap))

} else {
  print(paste0(i, ": Sorry, this country does not meet the median threshold."))
  }
}
```

```
## [1] "Afghanistan: Sorry, this country does not meet the median threshold."
## [1] "Albania: Sorry, this country does not meet the median threshold."
## [1] "Algeria: 4426.02597316667"
## [1] "Angola: 3607.10052883333"
## [1] "Argentina: 8955.55378266667"
## [1] "Australia: 19980.5956341667"
## [1] "Austria: 20411.9162793333"
## [1] "Bahrain: 18077.6639454167"
## [1] "Bangladesh: Sorry, this country does not meet the median threshold."
## [1] "Belgium: 19900.7580716667"
## [1] "Benin: Sorry, this country does not meet the median threshold."
## [1] "Bolivia: Sorry, this country does not meet the median threshold."
## [1] "Bosnia and Herzegovina: Sorry, this country does not meet the median threshold."
## [1] "Botswana: 5031.50355716667"
## [1] "Brazil: 5829.31665275"
## [1] "Bulgaria: 6384.055172"
## [1] "Burkina Faso: Sorry, this country does not meet the median threshold."
## [1] "Burundi: Sorry, this country does not meet the median threshold."
## [1] "Cambodia: Sorry, this country does not meet the median threshold."
## [1] "Cameroon: Sorry, this country does not meet the median threshold."
## [1] "Canada: 22410.74634"
## [1] "Central African Republic: Sorry, this country does not meet the median threshold."
## [1] "Chad: Sorry, this country does not meet the median threshold."
## [1] "Chile: 6703.28914708333"
## [1] "China: Sorry, this country does not meet the median threshold."
## [1] "Colombia: 4195.34291991667"
```

```
## [1] "Comoros: Sorry, this country does not meet the median threshold."
## [1] "Congo Dem. Rep.: Sorry, this country does not meet the median threshold."
## [1] "Congo Rep.: Sorry, this country does not meet the median threshold."
## [1] "Costa Rica: 5448.61077941667"
## [1] "Cote d'Ivoire: Sorry, this country does not meet the median threshold."
## [1] "Croatia: 9331.71234591667"
## [1] "Cuba: 6283.25867833333"
## [1] "Czech Republic: 13920.011379"
## [1] "Denmark: 21671.8248879167"
## [1] "Djibouti: Sorry, this country does not meet the median threshold."
## [1] "Dominican Republic: Sorry, this country does not meet the median threshold."
## [1] "Ecuador: 5733.62476675"
## [1] "Egypt: Sorry, this country does not meet the median threshold."
## [1] "El Salvador: 4431.84659733333"
## [1] "Equatorial Guinea: Sorry, this country does not meet the median threshold."
## [1] "Eritrea: Sorry, this country does not meet the median threshold."
## [1] "Ethiopia: Sorry, this country does not meet the median threshold."
## [1] "Finland: 17473.7226673333"
## [1] "France: 18833.5703270833"
## [1] "Gabon: 11529.8654744167"
## [1] "Gambia: Sorry, this country does not meet the median threshold."
## [1] "Germany: 20556.68443275"
## [1] "Ghana: Sorry, this country does not meet the median threshold."
## [1] "Greece: 13969.0368329167"
## [1] "Guatemala: 4015.40277141667"
## [1] "Guinea: Sorry, this country does not meet the median threshold."
## [1] "Guinea-Bissau: Sorry, this country does not meet the median threshold."
## [1] "Haiti: Sorry, this country does not meet the median threshold."
## [1] "Honduras: Sorry, this country does not meet the median threshold."
## [1] "Hong Kong China: 16228.70086475"
## [1] "Hungary: 10888.1756536667"
## [1] "Iceland: 20531.4222725"
## [1] "India: Sorry, this country does not meet the median threshold."
## [1] "Indonesia: Sorry, this country does not meet the median threshold."
## [1] "Iran: 7376.5829055"
## [1] "Iraq: 7811.80911666667"
## [1] "Ireland: 15758.60623775"
## [1] "Israel: 14160.9364340833"
## [1] "Italy: 16245.2090064167"
## [1] "Jamaica: 6197.645405"
## [1] "Japan: 17750.8699841667"
## [1] "Jordan: Sorry, this country does not meet the median threshold."
## [1] "Kenya: Sorry, this country does not meet the median threshold."
## [1] "Korea Dem. Rep.: Sorry, this country does not meet the median threshold."
## [1] "Korea Rep.: 8217.31848508333"
## [1] "Kuwait: 65332.9104716667"
## [1] "Lebanon: 7269.21624125"
## [1] "Lesotho: Sorry, this country does not meet the median threshold."
## [1] "Liberia: Sorry, this country does not meet the median threshold."
## [1] "Libya: 12013.57920125"
## [1] "Madagascar: Sorry, this country does not meet the median threshold."
## [1] "Malawi: Sorry, this country does not meet the median threshold."
## [1] "Malaysia: 5406.03819691667"
## [1] "Mali: Sorry, this country does not meet the median threshold."
```

```
## [1] "Mauritania: Sorry, this country does not meet the median threshold."
## [1] "Mauritius: 4768.94222125"
## [1] "Mexico: 7724.11267458333"
## [1] "Mongolia: Sorry, this country does not meet the median threshold."
## [1] "Montenegro: 7208.06455975"
## [1] "Morocco: Sorry, this country does not meet the median threshold."
## [1] "Mozambique: Sorry, this country does not meet the median threshold."
## [1] "Myanmar: Sorry, this country does not meet the median threshold."
## [1] "Namibia: 3675.58208683333"
## [1] "Nepal: Sorry, this country does not meet the median threshold."
## [1] "Netherlands: 21748.8522081667"
## [1] "New Zealand: 17262.6228125"
## [1] "Nicaragua: Sorry, this country does not meet the median threshold."
## [1] "Niger: Sorry, this country does not meet the median threshold."
## [1] "Nigeria: Sorry, this country does not meet the median threshold."
## [1] "Norway: 26747.3065541667"
## [1] "Oman: 12138.5622273333"
## [1] "Pakistan: Sorry, this country does not meet the median threshold."
## [1] "Panama: 5754.82717183333"
## [1] "Paraguay: Sorry, this country does not meet the median threshold."
## [1] "Peru: 5613.84408675"
## [1] "Philippines: Sorry, this country does not meet the median threshold."
## [1] "Poland: 8416.55391225"
## [1] "Portugal: 11354.0919274167"
## [1] "Puerto Rico: 10863.1643034167"
## [1] "Reunion: 4898.39839008333"
## [1] "Romania: 7300.16997358333"
## [1] "Rwanda: Sorry, this country does not meet the median threshold."
## [1] "Sao Tome and Principe: Sorry, this country does not meet the median threshold."
## [1] "Saudi Arabia: 20261.7436350833"
## [1] "Senegal: Sorry, this country does not meet the median threshold."
## [1] "Serbia: 9305.04944408333"
## [1] "Sierra Leone: Sorry, this country does not meet the median threshold."
## [1] "Singapore: 17425.3822666667"
## [1] "Slovak Republic: 10415.530689"
## [1] "Slovenia: 14074.5821093333"
## [1] "Somalia: Sorry, this country does not meet the median threshold."
## [1] "South Africa: 7247.43107441667"
## [1] "Spain: 14029.82647875"
## [1] "Sri Lanka: Sorry, this country does not meet the median threshold."
## [1] "Sudan: Sorry, this country does not meet the median threshold."
## [1] "Swaziland: Sorry, this country does not meet the median threshold."
## [1] "Sweden: 19943.126104"
## [1] "Switzerland: 27074.334405"
## [1] "Syria: Sorry, this country does not meet the median threshold."
## [1] "Taiwan: 10224.80718075"
## [1] "Tanzania: Sorry, this country does not meet the median threshold."
## [1] "Thailand: Sorry, this country does not meet the median threshold."
## [1] "Togo: Sorry, this country does not meet the median threshold."
## [1] "Trinidad and Tobago: 7866.87194641667"
## [1] "Tunisia: Sorry, this country does not meet the median threshold."
## [1] "Turkey: 4469.45337966667"
## [1] "Uganda: Sorry, this country does not meet the median threshold."
## [1] "United Kingdom: 19380.4729855833"
```

```
## [1] "United States: 26261.1513466667"
## [1] "Uruguay: 7100.13317566667"
## [1] "Venezuela: 10088.5162515833"
## [1] "Vietnam: Sorry, this country does not meet the median threshold."
## [1] "West Bank and Gaza: 3759.99678125"
## [1] "Yemen Rep.: Sorry, this country does not meet the median threshold."
## [1] "Zambia: Sorry, this country does not meet the median threshold."
## [1] "Zimbabwe: Sorry, this country does not meet the median threshold."
```

Functions

Create a function called `report_min_max` to calculate the minimum and maximum log gdp (i.e. not per capita) for Europe.

```r
report_min_max<-
  function(df, variable, continent){
    var<-gapminder[[variable]][gapminder$continent==continent]
    min_log_gdp<-min(log(var))
    max_log_gdp<-max(log(var))
    cat("Continent", continent,
        "\nMinimum Log GDP", min_log_gdp,
        "\nMaximum Log GDP", max_log_gdp)
  }

report_min_max(gapminder, "gdp", "Europe")
```

```
## Continent Europe
## Minimum Log GDP 20.7959
## Maximum Log GDP 28.60591
```

Putting things all together.

Change the following function to conform to the following: #1) Change the color to green (hint: the specification for color is `col`) #2) Instead of a log x variable, use a squared x variable. #3) Run the function as we did in the exercise from the lecture, but with the above new specifications for the year 1987.

```r
viz_lm <-
  function(df, dv, iv, year) {
    dat <- df[df[["year"]] == year, ]
    y <- log(dat[[dv]])
    x <- (dat[[iv]])^2
    fit <- lm(y ~ x)
    plot(y ~ x, main = year,
         xlab = iv, ylab = dv)
    lines(x, predict(fit), col = 'green')
  }

viz_lm(gapminder, "lifeExp", "gdpPercap", 1987)
```

1987