

# Esame scritto - Corso base R con soluzioni

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## Istruzioni

1. Leggi attentamente le consegne per ogni blocco.
  2. Puoi usare qualsiasi funzione di base o del tidyverse.
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## Tier 1 – Livello Base

### Esercizio 1: Caricamento ed esplorazione

Carica il file `aggregationComuniErg5_DAILY_PREC.csv` e salvalo in un oggetto chiamato `pioggia`.

```
pioggia <- read.csv("Data/aggregationComuniErg5_DAILY_PREC.csv")
```

### Esercizio 2: Mostra le prime 5 righe del dataset `pioggia`.

```
head(pioggia, 5)
```

```
##           Date X1_AVG_D X2_AVG_D X3_AVG_D X4_AVG_D X5_AVG_D X6_AVG_D X7_AVG_D
## 1 2001-01-01    0.1    0.0    0.0    0.0    0.0    0.0    0.0
## 2 2001-01-02    6.8    9.7    7.5   12.8   15.2    6.0    8.7
## 3 2001-01-03    0.7    0.1    0.0    0.7    2.0    0.5    0.0
## 4 2001-01-04    9.2    7.5    8.7    5.0    8.6    9.2    8.1
## 5 2001-01-05    1.3    1.3    1.3    1.5    4.4    0.9    1.8
##  X8_AVG_D X9_AVG_D X10_AVG_D X11_AVG_D X12_AVG_D X13_AVG_D X14_AVG_D X15_AVG_D
## 1    0.1    0.0    0.0    0.0    0.0    0.0    0.5    0.0
## 2    4.0    5.1   10.0    9.7    5.4    8.5   29.6   19.2
## 3    0.2    0.0    0.1    0.1    0.2    0.0    0.0    0.6
## 4    7.1    5.4    7.1    6.5    9.1   10.0   14.1    9.4
## 5    0.6    1.1    1.6    1.5    0.8    1.9    7.9    4.3
##  X16_AVG_D X17_AVG_D X18_AVG_D X19_AVG_D X20_AVG_D X21_AVG_D X22_AVG_D
## 1    0.1    0.0    0.0    0.1    0.0    0.1    0.1
## 2   24.9    8.1   11.9   26.0    9.2    8.0    4.7
## 3    0.1    0.0    0.7    0.2    0.0    0.6    0.0
## 4   12.7    8.9    7.6   12.7    7.8    9.3    6.1
```

## 5	6.0	1.7	3.3	6.1	1.6	1.7	0.9
##	X23_AVG_D	X24_AVG_D	X25_AVG_D	X26_AVG_D	X27_AVG_D	X28_AVG_D	X29_AVG_D
## 1	0.1	0.0	0.0	0.0	0.0	2.8	0.0
## 2	6.3	10.8	10.8	7.5	6.7	39.1	1.6
## 3	0.1	0.8	0.6	0.0	2.4	0.1	0.0
## 4	9.2	4.4	5.9	8.7	14.7	17.6	1.8
## 5	1.2	1.1	1.4	1.7	2.8	15.0	0.3
##	X30_AVG_D	X31_AVG_D	X32_AVG_D	X33_AVG_D	X34_AVG_D	X35_AVG_D	X36_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
## 2	6.7	7.2	5.2	11.4	6.3	9.7	5.2
## 3	1.8	1.6	0.1	0.6	0.0	0.5	0.2
## 4	8.5	8.8	4.7	6.6	5.7	8.5	8.7
## 5	1.6	1.7	1.1	1.9	1.3	2.1	0.8
##	X37_AVG_D	X38_AVG_D	X39_AVG_D	X40_AVG_D	X41_AVG_D	X42_AVG_D	X43_AVG_D
## 1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
## 2	9.7	8.1	5.4	11.4	11.4	10.8	8.2
## 3	0.2	0.0	0.2	1.0	0.8	0.5	0.0
## 4	7.7	9.3	9.6	7.6	8.4	8.3	9.8
## 5	1.8	1.8	0.8	2.2	2.0	2.2	1.8
##	X44_AVG_D	X45_AVG_D	X46_AVG_D	X47_AVG_D	X48_AVG_D	X49_AVG_D	X50_AVG_D
## 1	2.1	0.0	0.0	0.3	0.0	0.4	1.6
## 2	34.6	5.8	6.6	44.1	24.5	43.7	45.9
## 3	0.1	1.4	2.2	1.3	1.2	0.7	3.0
## 4	16.1	8.7	7.2	23.6	14.2	20.8	12.3
## 5	13.3	1.3	2.0	9.2	5.3	11.1	6.7
##	X51_AVG_D	X52_AVG_D	X53_AVG_D	X54_AVG_D	X55_AVG_D	X56_AVG_D	X57_AVG_D
## 1	0.0	0.3	0.0	0.0	0.0	0.0	0.2
## 2	11.9	31.3	6.6	12.0	8.5	6.7	35.8
## 3	2.4	0.7	0.2	0.7	0.3	0.2	0.7
## 4	11.8	14.0	7.9	3.7	6.2	7.7	18.2
## 5	3.1	3.2	0.9	0.3	0.4	0.3	8.0
##	X58_AVG_D	X59_AVG_D	X60_AVG_D	X61_AVG_D	X62_AVG_D	X63_AVG_D	X64_AVG_D
## 1	3.0	0.0	0.0	0.0	0.1	0.0	0.0
## 2	64.7	9.1	8.1	6.9	7.7	9.7	9.4
## 3	4.9	0.6	0.2	0.4	0.2	0.5	0.7
## 4	14.8	5.5	8.5	7.9	6.8	5.0	5.0
## 5	11.3	0.3	1.0	1.0	0.6	0.3	0.2
##	X65_AVG_D	X66_AVG_D	X67_AVG_D	X68_AVG_D	X69_AVG_D	X70_AVG_D	X71_AVG_D
## 1	0.0	0.0	1.9	0.0	0.0	0.0	0.1
## 2	8.7	8.5	70.4	8.2	9.1	8.2	24.8
## 3	0.7	0.2	3.3	0.6	1.0	0.2	2.6
## 4	5.0	9.0	19.6	4.8	5.1	7.9	6.9
## 5	0.1	0.9	9.6	0.0	0.1	0.8	1.4
##	X72_AVG_D	X73_AVG_D	X74_AVG_D	X75_AVG_D	X76_AVG_D	X77_AVG_D	X78_AVG_D
## 1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
## 2	8.3	12.0	5.6	8.8	10.1	5.9	13.6
## 3	0.2	0.3	0.4	0.5	0.1	0.4	0.5
## 4	5.7	9.1	8.0	5.8	9.1	8.0	7.1
## 5	0.1	1.8	0.8	0.4	1.5	0.9	0.8
##	X79_AVG_D	X80_AVG_D	X81_AVG_D	X82_AVG_D	X83_AVG_D	X84_AVG_D	X85_AVG_D
## 1	0.0	0.0	0.1	1.1	0.0	0.0	0.2
## 2	6.4	11.5	17.6	68.1	6.7	8.3	26.8
## 3	0.6	0.6	1.9	0.6	0.2	0.7	0.4
## 4	8.3	3.3	5.5	27.1	7.2	4.5	11.6

## 5	1.2	0.1	0.9	16.9	0.3	0.0	1.6
##	X86_AVG_D	X87_AVG_D	X88_AVG_D	X89_AVG_D	X90_AVG_D	X91_AVG_D	X92_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	10.3	22.0	5.5	6.5	8.1	7.2	7.4
## 3	0.3	1.3	0.2	0.2	0.3	0.1	1.6
## 4	9.0	12.8	7.7	8.2	7.3	7.0	6.6
## 5	1.3	3.5	0.5	1.1	0.1	0.0	0.0
##	X93_AVG_D	X94_AVG_D	X95_AVG_D	X96_AVG_D	X97_AVG_D	X98_AVG_D	X99_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
## 2	4.7	8.0	7.8	8.2	8.3	6.0	8.6
## 3	0.3	0.6	0.2	0.2	0.5	2.0	0.4
## 4	4.0	5.0	7.7	7.5	6.2	7.3	5.5
## 5	0.6	0.0	0.0	0.1	0.0	0.1	0.0
##	X100_AVG_D	X101_AVG_D	X102_AVG_D	X103_AVG_D	X104_AVG_D	X105_AVG_D	X106_AVG_D
## 1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
## 2	5.7	3.1	6.9	3.9	9.1	11.5	7.9
## 3	0.5	1.6	0.2	0.5	0.3	0.9	0.5
## 4	5.0	6.8	4.6	5.8	6.2	8.2	5.4
## 5	1.2	0.0	0.4	0.0	0.0	0.8	0.1
##	X107_AVG_D	X108_AVG_D	X109_AVG_D	X110_AVG_D	X111_AVG_D	X112_AVG_D	X113_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	9.3	6.1	6.9	8.4	8.0	7.7	8.0
## 3	0.6	3.3	0.9	0.3	0.3	0.6	0.8
## 4	5.9	7.1	7.0	6.0	7.6	9.1	9.8
## 5	0.0	0.2	0.0	0.0	0.0	0.0	0.0
##	X114_AVG_D	X115_AVG_D	X116_AVG_D	X117_AVG_D	X118_AVG_D	X119_AVG_D	X120_AVG_D
## 1	0.1	0.0	0.0	0.1	0.0	0.0	0.0
## 2	8.0	6.5	8.6	7.5	7.5	7.6	5.5
## 3	0.6	1.3	0.2	0.4	0.7	0.6	2.7
## 4	5.0	7.7	5.8	5.3	7.7	6.2	7.2
## 5	0.1	0.0	0.0	0.1	0.0	0.0	0.1
##	X121_AVG_D	X122_AVG_D	X123_AVG_D	X124_AVG_D	X125_AVG_D	X126_AVG_D	X127_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
## 2	7.0	6.0	6.8	8.0	8.1	6.9	5.0
## 3	1.2	1.7	2.6	0.6	0.5	0.3	2.5
## 4	6.6	7.4	6.8	4.6	5.6	8.0	4.9
## 5	0.0	0.1	0.2	0.0	0.0	0.0	2.6
##	X128_AVG_D	X129_AVG_D	X130_AVG_D	X131_AVG_D	X132_AVG_D	X133_AVG_D	X134_AVG_D
## 1	0.0	0.0	0.0	0.0	0.3	0.0	0.1
## 2	11.8	6.5	5.9	23.9	35.9	1.5	1.4
## 3	1.0	0.2	0.0	4.7	10.3	2.8	2.9
## 4	7.7	4.9	5.1	9.3	13.7	8.3	8.2
## 5	0.1	0.2	0.2	2.4	3.3	0.3	0.2
##	X135_AVG_D	X136_AVG_D	X137_AVG_D	X138_AVG_D	X139_AVG_D	X140_AVG_D	X141_AVG_D
## 1	0.0	0.5	0.0	0.1	0.0	0.0	0.1
## 2	4.8	1.6	2.9	0.4	0.2	0.3	1.5
## 3	1.7	2.6	3.6	1.5	1.6	1.1	5.3
## 4	7.5	9.3	7.9	8.5	5.8	6.3	7.7
## 5	0.1	0.0	0.1	0.0	0.0	0.3	0.0
##	X142_AVG_D	X143_AVG_D	X144_AVG_D	X145_AVG_D	X146_AVG_D	X147_AVG_D	X148_AVG_D
## 1	0.0	0.1	0.6	0.0	0.6	0.0	0.6
## 2	3.4	15.9	0.8	0.3	15.8	0.5	26.3
## 3	4.4	1.6	3.3	2.3	1.5	2.7	1.5
## 4	8.0	8.9	10.5	4.7	4.6	6.8	7.9

## 5	0.0	0.7	0.0	0.0	1.4	0.0	1.9
##	X149_AVG_D	X150_AVG_D	X151_AVG_D	X152_AVG_D	X153_AVG_D	X154_AVG_D	X155_AVG_D
## 1	0.0	0.1	0.0	0.0	0.4	0.3	0.0
## 2	1.4	4.8	0.3	1.1	1.5	3.5	1.7
## 3	3.2	2.4	1.7	2.4	3.7	2.6	1.6
## 4	7.9	4.9	5.6	7.5	8.9	10.2	6.7
## 5	2.9	0.5	0.1	2.2	0.0	0.0	0.0
##	X156_AVG_D	X157_AVG_D	X158_AVG_D	X159_AVG_D	X160_AVG_D	X161_AVG_D	X162_AVG_D
## 1	0.1	0.1	0.0	0.0	0.0	0.2	0.0
## 2	7.6	4.4	5.3	1.0	4.0	5.7	1.4
## 3	1.9	3.7	1.9	2.0	3.8	2.8	3.1
## 4	7.1	3.8	7.0	6.6	7.0	3.6	5.4
## 5	0.3	2.4	0.5	0.2	0.0	1.7	0.4
##	X163_AVG_D	X164_AVG_D	X165_AVG_D	X166_AVG_D	X167_AVG_D	X168_AVG_D	X169_AVG_D
## 1	2.8	0.0	0.0	0.1	0.4	0.2	0.7
## 2	34.7	2.3	3.6	1.4	16.6	0.2	1.1
## 3	1.9	2.8	0.8	1.7	1.9	1.0	3.4
## 4	5.2	5.0	5.5	6.5	6.3	6.6	10.1
## 5	1.8	0.7	0.4	0.2	1.2	0.0	0.0
##	X170_AVG_D	X171_AVG_D	X172_AVG_D	X173_AVG_D	X174_AVG_D	X175_AVG_D	X176_AVG_D
## 1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
## 2	2.4	0.8	1.5	1.1	1.7	6.8	0.9
## 3	5.5	4.2	1.5	1.8	1.8	2.0	3.8
## 4	7.3	8.4	4.6	7.6	5.6	7.4	8.5
## 5	0.0	0.1	0.0	1.5	0.4	0.1	0.1
##	X177_AVG_D	X178_AVG_D	X179_AVG_D	X180_AVG_D	X181_AVG_D	X182_AVG_D	X183_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	0.1	0.5	1.6	0.0	0.0	0.0	0.0
## 3	0.7	1.0	2.4	2.5	1.0	0.9	0.4
## 4	5.0	6.3	8.3	12.9	12.7	11.5	11.0
## 5	0.1	0.7	1.7	0.0	0.0	0.0	0.0
##	X184_AVG_D	X185_AVG_D	X186_AVG_D	X187_AVG_D	X188_AVG_D	X189_AVG_D	X190_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	0.1	0.0	0.0	0.0	14.9	0.1	0.2
## 3	1.3	2.0	1.4	1.9	2.6	1.4	1.4
## 4	15.4	17.4	14.5	13.8	7.6	14.8	15.1
## 5	0.1	0.1	0.6	0.0	2.0	0.1	0.6
##	X191_AVG_D	X192_AVG_D	X193_AVG_D	X194_AVG_D	X195_AVG_D	X196_AVG_D	X197_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	2.9	2.1	15.1	0.0	0.0	0.0	0.2
## 3	1.1	2.3	1.6	1.1	0.8	1.1	0.7
## 4	7.1	7.6	7.7	16.6	11.7	14.1	17.5
## 5	0.8	2.5	1.3	0.3	0.1	0.0	0.6
##	X198_AVG_D	X199_AVG_D	X200_AVG_D	X201_AVG_D	X202_AVG_D	X203_AVG_D	X204_AVG_D
## 1	0.1	0.0	0.2	0.0	0.0	0.0	0.0
## 2	0.0	14.6	0.9	0.0	0.2	7.9	0.0
## 3	1.1	2.3	2.0	0.7	1.9	0.7	0.3
## 4	13.6	8.2	8.4	17.2	13.0	7.1	3.1
## 5	2.1	2.9	0.2	0.3	1.1	0.4	0.1
##	X205_AVG_D	X206_AVG_D	X207_AVG_D	X208_AVG_D	X209_AVG_D	X210_AVG_D	X211_AVG_D
## 1	0.0	0.0	0.0	0.3	0.3	0.0	0.1
## 2	0.0	2.9	0.1	29.5	1.2	0.0	1.7
## 3	1.0	1.0	0.9	2.1	1.6	0.8	1.8
## 4	14.4	8.5	15.2	11.8	11.7	8.7	12.6

## 5	0.3	0.5	0.2	1.4	0.2	0.1	1.0
##	X212_AVG_D	X213_AVG_D	X214_AVG_D	X215_AVG_D	X216_AVG_D	X217_AVG_D	X218_AVG_D
## 1	0.2	0.0	0.8	1.0	0.1	0.0	0.2
## 2	0.1	0.0	0.5	3.5	1.4	1.2	2.0
## 3	1.3	0.9	1.4	1.7	1.2	1.3	2.1
## 4	12.0	12.6	10.2	8.7	12.6	11.2	11.6
## 5	0.4	0.1	0.4	0.6	0.5	0.6	0.4
##	X219_AVG_D	X220_AVG_D	X221_AVG_D	X222_AVG_D	X223_AVG_D	X224_AVG_D	X225_AVG_D
## 1	0.0	0.1	0.5	0.0	0.0	0.3	0.0
## 2	0.1	0.5	2.2	0.0	0.0	5.3	0.0
## 3	1.1	0.7	0.7	0.4	1.8	1.7	0.4
## 4	13.8	18.3	16.5	7.4	12.9	7.9	11.0
## 5	0.2	1.4	0.1	0.1	0.1	1.0	0.0
##	X226_AVG_D	X227_AVG_D	X228_AVG_D	X229_AVG_D	X230_AVG_D	X231_AVG_D	X232_AVG_D
## 1	0.0	0.1	0.0	0.0	0.2	0.0	0.0
## 2	0.1	0.2	0.0	0.3	1.0	2.0	0.2
## 3	1.8	0.9	0.3	1.5	1.4	1.3	1.7
## 4	10.4	18.5	5.8	6.4	13.8	8.9	14.0
## 5	0.2	1.2	0.1	0.3	0.2	1.4	0.0
##	X233_AVG_D	X234_AVG_D	X235_AVG_D	X236_AVG_D	X237_AVG_D	X238_AVG_D	X239_AVG_D
## 1	0.0	0.4	1.0	0.1	0.1	0.0	0.0
## 2	0.9	31.6	0.8	2.4	0.2	0.4	0.2
## 3	2.2	2.5	1.0	2.7	1.0	0.8	0.8
## 4	10.9	11.2	11.4	10.5	9.0	5.1	9.4
## 5	1.0	2.2	0.5	0.0	0.1	0.5	0.3
##	X240_AVG_D	X241_AVG_D	X242_AVG_D	X243_AVG_D	X244_AVG_D	X245_AVG_D	X246_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	0.3	0.5	0.3	0.2	0.2	0.6	0.1
## 3	0.6	1.1	0.6	1.2	1.0	0.5	1.1
## 4	8.3	11.0	5.7	5.6	8.9	4.6	8.6
## 5	0.2	0.0	0.2	0.6	0.0	0.4	0.1
##	X247_AVG_D	X248_AVG_D	X249_AVG_D	X250_AVG_D	X251_AVG_D	X252_AVG_D	X253_AVG_D
## 1	0.0	0.7	0.0	0.0	0.0	0.0	0.0
## 2	0.1	0.5	1.1	0.2	0.5	0.2	0.3
## 3	0.7	1.3	1.8	1.0	0.8	1.1	0.6
## 4	5.5	9.4	9.7	10.8	5.0	6.3	5.0
## 5	0.2	0.3	0.0	0.0	0.5	0.4	0.0
##	X254_AVG_D	X255_AVG_D	X256_AVG_D	X257_AVG_D	X258_AVG_D	X259_AVG_D	X260_AVG_D
## 1	0.0	0.0	0.2	0.0	0.0	0.0	0.0
## 2	0.4	0.2	0.2	0.0	0.0	2.1	1.7
## 3	0.6	0.8	0.6	0.3	0.7	1.4	1.3
## 4	7.5	7.5	13.1	14.2	13.9	10.3	9.7
## 5	0.3	0.1	0.1	0.0	0.1	0.1	0.6
##	X261_AVG_D	X262_AVG_D	X263_AVG_D	X264_AVG_D	X265_AVG_D	X266_AVG_D	X267_AVG_D
## 1	0.0	0.0	0.5	0.0	0.0	0.0	0.2
## 2	0.2	0.3	0.4	0.1	0.5	0.0	0.1
## 3	0.8	0.4	1.2	0.4	0.8	0.5	0.7
## 4	11.3	8.9	11.7	14.0	12.6	14.0	13.7
## 5	0.2	0.0	0.3	0.1	0.1	0.0	0.1
##	X268_AVG_D	X269_AVG_D	X270_AVG_D	X271_AVG_D	X272_AVG_D	X273_AVG_D	X274_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
## 2	0.1	0.1	0.0	0.2	0.0	0.2	6.5
## 3	1.0	0.2	1.2	0.4	0.9	0.7	4.2
## 4	14.5	13.4	14.2	15.2	14.8	12.8	5.9

## 5	0.2	0.0	0.1	0.0	0.2	0.1	0.2
##	X275_AVG_D	X276_AVG_D	X277_AVG_D	X278_AVG_D	X279_AVG_D	X280_AVG_D	X281_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
## 2	1.3	0.1	1.3	0.9	1.0	1.7	2.8
## 3	2.0	3.7	1.7	3.6	1.2	5.3	2.7
## 4	8.6	8.1	9.6	8.1	8.3	4.2	5.8
## 5	0.0	0.2	0.2	0.6	0.0	0.1	0.1
##	X282_AVG_D	X283_AVG_D	X284_AVG_D	X285_AVG_D	X286_AVG_D	X287_AVG_D	X288_AVG_D
## 1	0.1	0.2	0.2	0.0	0.0	0.0	0.0
## 2	0.8	1.0	5.0	0.8	0.7	0.5	1.1
## 3	1.0	1.3	4.7	3.3	2.5	4.4	3.5
## 4	10.4	10.0	4.3	9.8	8.8	9.3	6.3
## 5	0.1	0.0	0.2	0.1	0.0	0.3	0.0
##	X289_AVG_D	X290_AVG_D	X291_AVG_D	X292_AVG_D	X293_AVG_D	X294_AVG_D	X295_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	1.1	1.9	0.3	16.0	2.9	12.2	9.3
## 3	4.8	2.0	5.8	10.8	4.0	8.0	5.0
## 4	4.5	7.7	8.4	8.2	6.3	7.0	5.6
## 5	0.2	0.2	0.9	0.2	0.2	0.3	0.1
##	X296_AVG_D	X297_AVG_D	X298_AVG_D	X299_AVG_D	X300_AVG_D	X301_AVG_D	X302_AVG_D
## 1	0.0	0.0	0.2	0.0	0.0	0.0	0.1
## 2	0.3	0.4	10.8	1.3	0.4	0.6	11.1
## 3	6.1	2.9	4.8	3.9	3.4	4.7	7.1
## 4	6.8	8.7	6.3	4.9	8.9	5.5	6.6
## 5	1.1	0.0	0.3	0.2	0.0	0.4	0.1
##	X303_AVG_D	X304_AVG_D	X305_AVG_D	X306_AVG_D	X307_AVG_D	X308_AVG_D	X309_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	4.2	0.4	0.0	0.0	0.0	0.0	0.0
## 3	5.0	2.5	1.3	1.0	1.1	1.2	4.1
## 4	7.4	8.4	9.7	7.6	7.2	8.6	11.2
## 5	0.1	0.0	0.0	0.1	0.0	0.0	0.0
##	X310_AVG_D	X311_AVG_D	X312_AVG_D	X313_AVG_D	X314_AVG_D	X315_AVG_D	X316_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 3	2.4	3.9	1.9	1.2	2.1	3.1	1.4
## 4	9.1	11.1	8.7	8.7	8.9	10.3	8.1
## 5	0.0	0.0	0.0	0.1	0.0	0.0	0.0
##	X317_AVG_D	X318_AVG_D	X319_AVG_D	X320_AVG_D	X321_AVG_D	X322_AVG_D	X323_AVG_D
## 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
## 2	0.0	0.0	0.0	1.9	0.1	0.1	0.3
## 3	1.7	3.4	1.7	5.5	4.7	4.0	5.4
## 4	9.4	8.8	7.0	11.3	6.4	6.1	8.6
## 5	0.0	0.0	0.1	0.4	0.7	0.5	1.0
##	X324_AVG_D	X325_AVG_D	X326_AVG_D	X327_AVG_D	X328_AVG_D	X329_AVG_D	X330_AVG_D
## 1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
## 2	0.1	0.6	0.2	0.0	0.0	0.1	0.0
## 3	2.6	4.0	4.7	2.5	0.8	4.4	1.0
## 4	5.9	7.1	6.1	7.1	6.8	7.0	6.1
## 5	0.4	0.6	0.6	0.2	0.0	0.8	0.1

### Esercizio 3: Qual è la dimensione del dataset pioggia? (righe e colonne?)

```
dim(pioggia)
```

```
## [1] 8878 331
```

### Esercizio 4: Calcola la pioggia media per la stazione 1\_AVG\_D nel periodo coperto.

Suggerimenti: per accedere alla colonna X1\_AVG\_D la sintassi è : pioggia\$X1\_AVG\_D

```
mean(pioggia$X1_AVG_D, na.rm = TRUE)
```

```
## [1] 2.10793
```

### Esercizio 5: Quanti giorni hanno registrato più di 10 mm nella stazione X5\_AVG\_D?

Suggerimenti: sum(pioggia\$X5\_AVG\_D .....)

```
sum(pioggia$X5_AVG_D > 10, na.rm = TRUE)
```

```
## [1] 662
```

### Esercizio 6: Crea una nuova variabile totale\_mensile che somma le piogge della stazione X1\_AVG\_D per mese.

Suggerimento-> usa la sintassi per creare due nuove variabile mese (month) e anno (year): “mutate ( year = year(Date), month = month(Date))” successivamente, usa group\_by Scheletro: pioggia\_monthly <- pioggia %>% mutate(year = year(Date), month = month(Date)) %>% group\_by(year, month ) %>% summarise(sum\_monthly = ..... ) |> ungroup()

```
pioggia_monthly <- pioggia %>%  
  select(c(Date,X1_AVG_D)) %>%  
  mutate(year = year(Date), month = month(Date)) %>%  
  group_by(year, month ) %>%  
  summarise(  
    sum_monthly = sum(X1_AVG_D, na.rm = TRUE), # or sum(...) if you prefer  
  ) %>%  
  ungroup()
```

```
## 'summarise()' has grouped output by 'year'. You can override using the  
## '.groups' argument.
```

```
pioggia_monthly
```

```
## # A tibble: 292 x 3
##   year month sum_monthly
##   <dbl> <dbl>      <dbl>
## 1  2001     1        56.6
## 2  2001     2        13.6
## 3  2001     3        88.8
## 4  2001     4        42.8
## 5  2001     5        75.3
## 6  2001     6        91.5
## 7  2001     7        97.2
## 8  2001     8         50
## 9  2001     9        94.6
## 10 2001    10        61.3
## # i 282 more rows
```

## Esercizio 7: Qual è il giorno con più pioggia totale?

Suggerimento-> Scheletro:

```
pioggia_monthly %>%
  filter(max_monthly == ....) %>%
  select(.....)
```

```
pioggia_monthly %>%
  filter(sum_monthly == max(sum_monthly)) %>%
  select(month, sum_monthly)
```

```
## # A tibble: 1 x 2
##   month sum_monthly
##   <dbl>      <dbl>
## 1     11        281.
```

## Esercizio 8: Crea un grafico della pioggia giornaliera della stazione X1\_AVG\_D nel primo mese del dataset.

Suggerimenti: per accedere al primo mese del dataset la sintassi è :

```
filter(month(Date) == 1, year(Date) == 2001) %>%
```

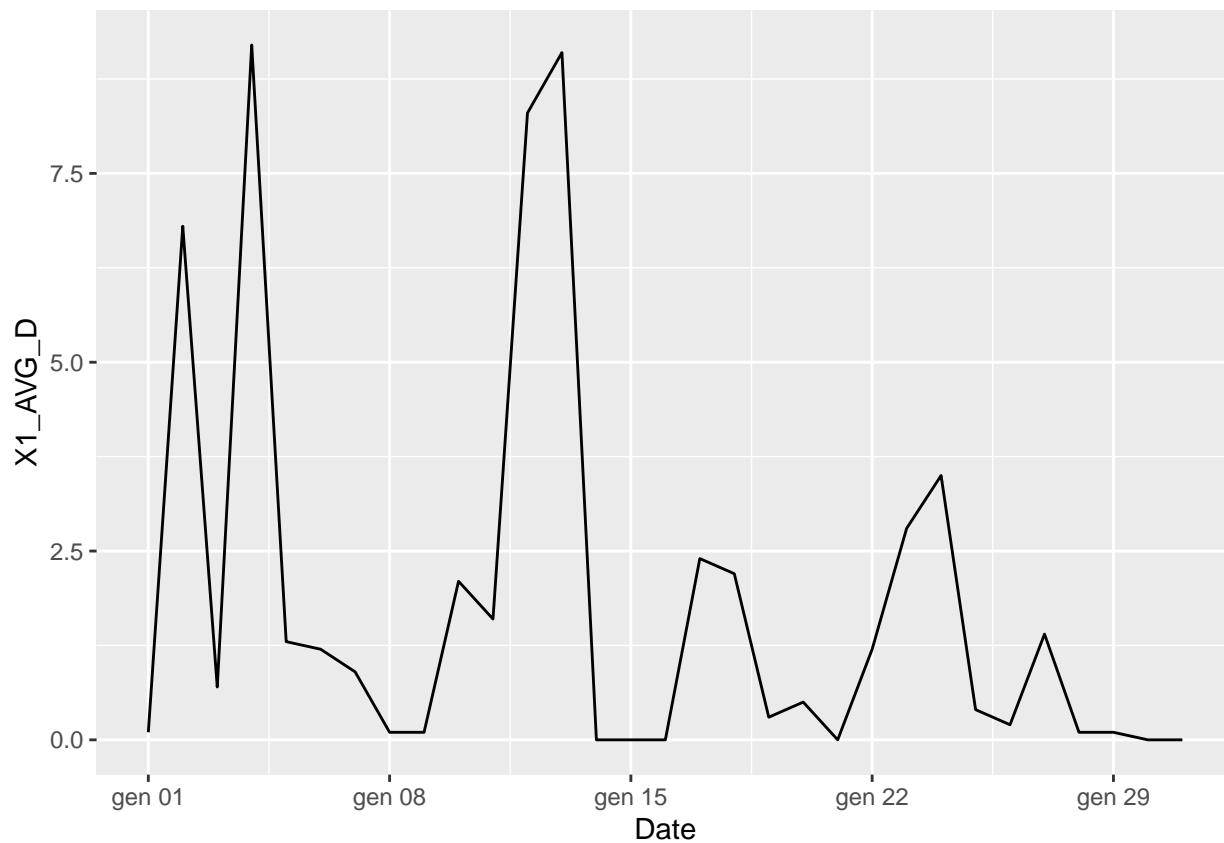
Scheletro: pioggia\_filtrata <- pioggia %>% filter(month(Date) == 1, year(Date) == 2001) %>% mutate(Date = as.Date(Date))

ggplot(data = pioggia\_filtrata, aes( )) + geom\_line() #oppure geom\_bar()

```
# in due passaggi:
pioggia_filtrata <- pioggia %>%
  filter(month(Date) == 1, year(Date) == 2001) %>%
  mutate(Date = as.Date(Date))

ggplot(data = pioggia_filtrata, aes(x = Date, y = X1_AVG_D)) +
  geom_line() #oppure geom_bar()
```

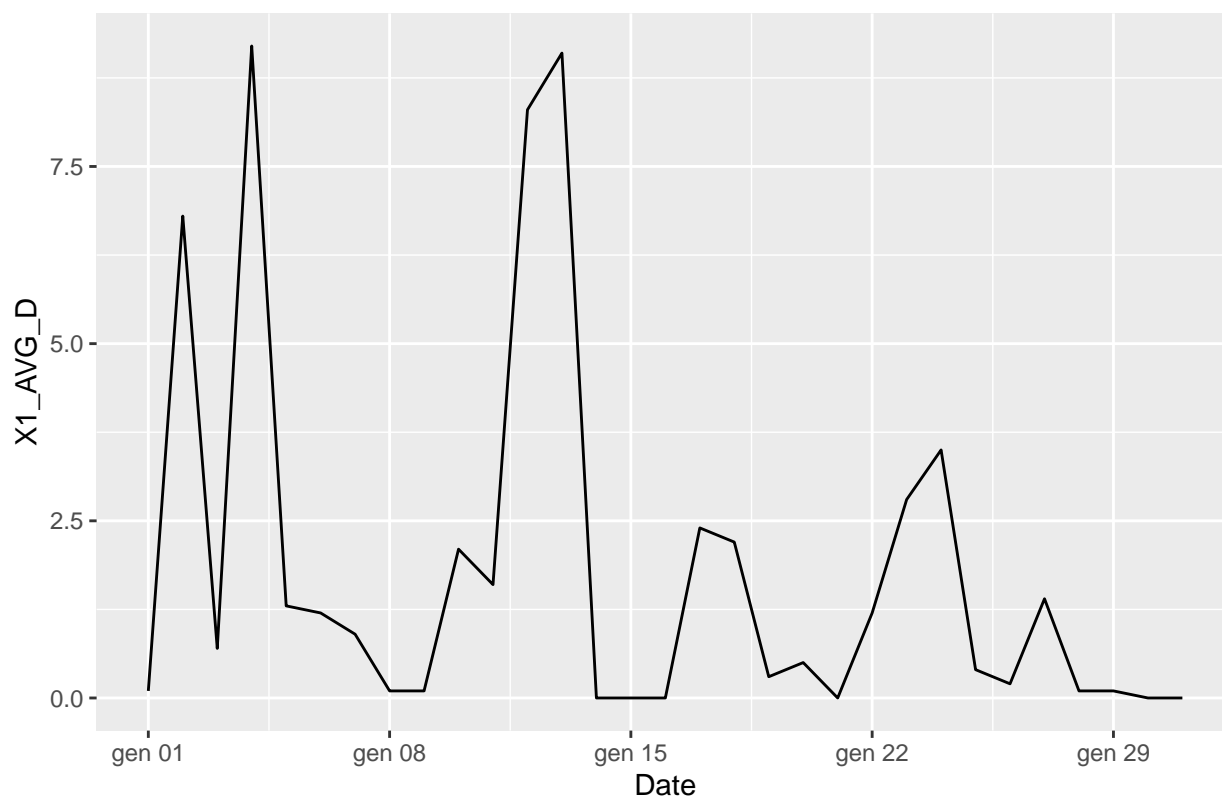




```
# oppure in un solo passaggio:
pioggia %>%
  filter(month(Date) == 1, year(Date) == 2001) %>%
  mutate(Date = as.Date(Date)) %>%

  ggplot(aes(x = Date, y = X1_AVG_D)) +
  geom_line() +
  labs(title = "Pioggia giornaliera - Stazione 1, Gennaio 2001")
```

## Pioggia giornaliera – Stazione 1, Gennaio 2001



## Tier 2 – Livello Avanzato

### Esercizio 1: Dati in formato long (BONUS)

```
pioggia_long <- pioggia %>%  
  pivot_longer(cols = -Date, names_to = "Stazione", values_to = "Pioggia")  
  
pioggia_long %>%  
  group_by(Stazione) %>%  
  summarise(media = mean(Pioggia, na.rm = TRUE))
```

```
## # A tibble: 330 x 2  
##   Stazione  media  
##   <chr>    <dbl>  
## 1 X100_AVG_D 2.32  
## 2 X101_AVG_D 2.06  
## 3 X102_AVG_D 2.14  
## 4 X103_AVG_D 2.16  
## 5 X104_AVG_D 1.91  
## 6 X105_AVG_D 2.48  
## 7 X106_AVG_D 2.15
```

```
## 8 X107_AVG_D 2.29
## 9 X108_AVG_D 1.99
## 10 X109_AVG_D 1.86
## # i 320 more rows
```

## Esercizio 2: Filtraggio e sintesi

```
pioggia_2002 <- pioggia %>%
  filter(year(Date) == 2002) %>%
  select(c(Date, X1_AVG_D)) %>%
  mutate(month = month(Date)) %>%
  group_by(month) %>%
  summarise(sum_monthly = sum(X1_AVG_D, na.rm = TRUE))

pioggia_2002 %>%
  filter(sum_monthly == max(sum_monthly))
```

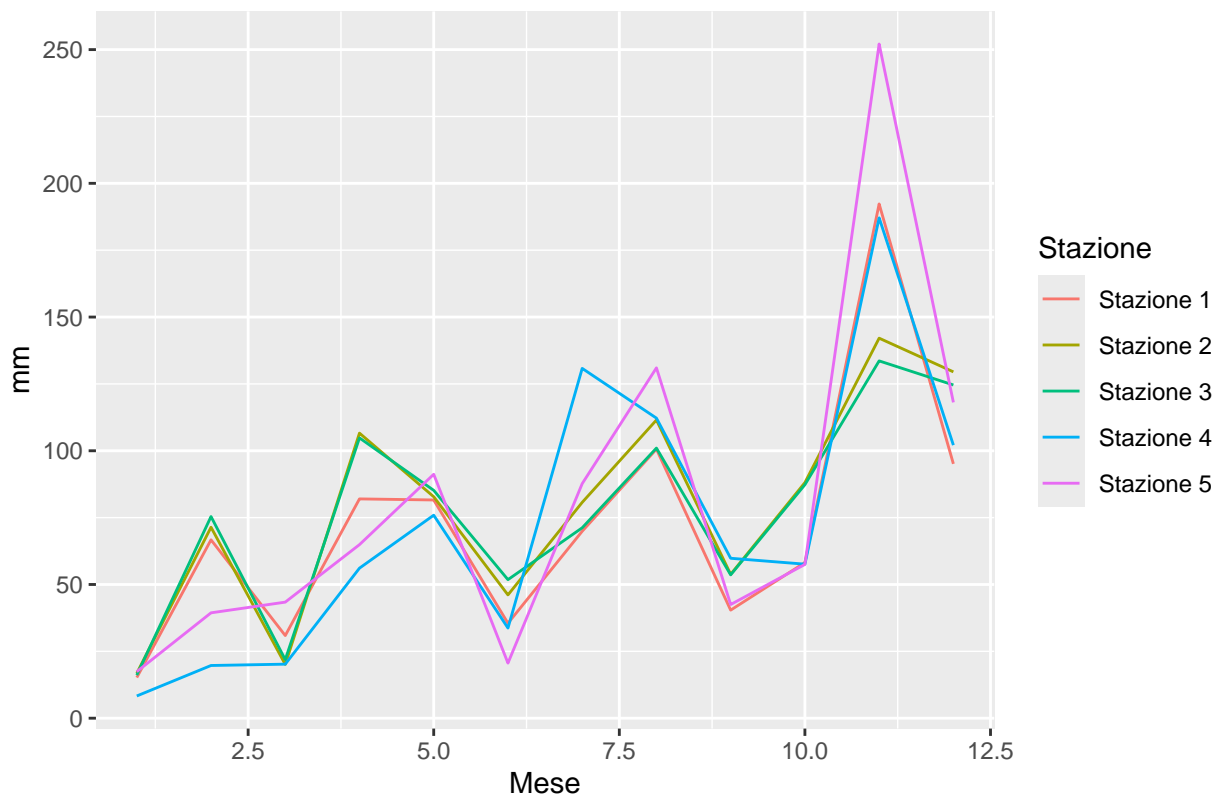
```
## # A tibble: 1 x 2
##   month sum_monthly
##   <dbl>         <dbl>
## 1     11         192.
```

## Esercizio 3: Grafico con ggplot2

```
pioggia_mensile <- pioggia %>%
  select(Date, X1_AVG_D : X5_AVG_D) %>%
  filter(year(Date) == 2002) %>%
  mutate(Mese = month(Date)) %>%
  group_by(Mese) %>%
  summarise(
    Stazione_1 = sum(X1_AVG_D, na.rm = TRUE),
    Stazione_2 = sum(X2_AVG_D, na.rm = TRUE),
    Stazione_3 = sum(X3_AVG_D, na.rm = TRUE),
    Stazione_4 = sum(X4_AVG_D, na.rm = TRUE),
    Stazione_5 = sum(X5_AVG_D, na.rm = TRUE),
    .groups = "drop"
  )

# Ricostruisce il grafico usando il formato largo
ggplot(pioggia_mensile, aes(x = Mese)) +
  geom_line(aes(y = Stazione_1, color = "Stazione 1")) +
  geom_line(aes(y = Stazione_2, color = "Stazione 2")) +
  geom_line(aes(y = Stazione_3, color = "Stazione 3")) +
  geom_line(aes(y = Stazione_4, color = "Stazione 4")) +
  geom_line(aes(y = Stazione_5, color = "Stazione 5")) +
  labs(title = "Pioggia cumulata mensile - Prime 5 stazioni (2002)", y = "mm", color = "Stazione")
```

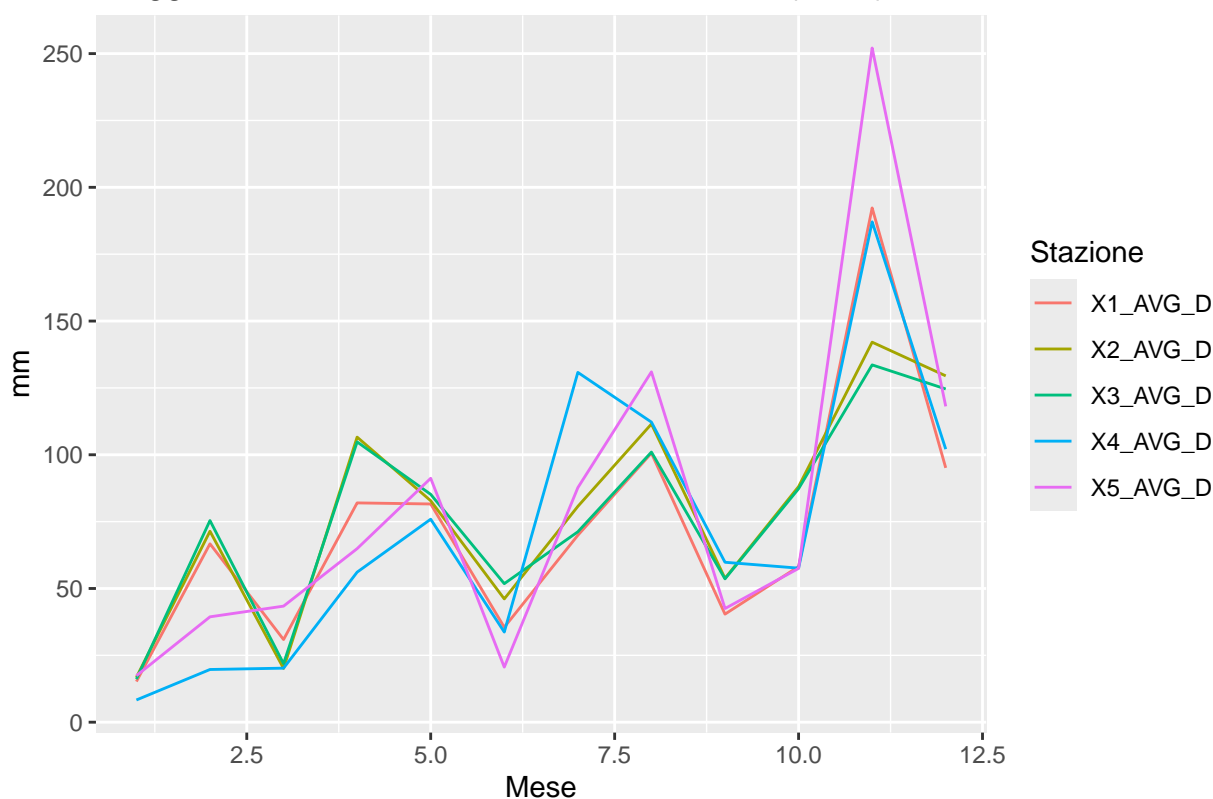
Pioggia cumulata mensile – Prime 5 stazioni (2002)



*# Alternativa con pivot\_longer*

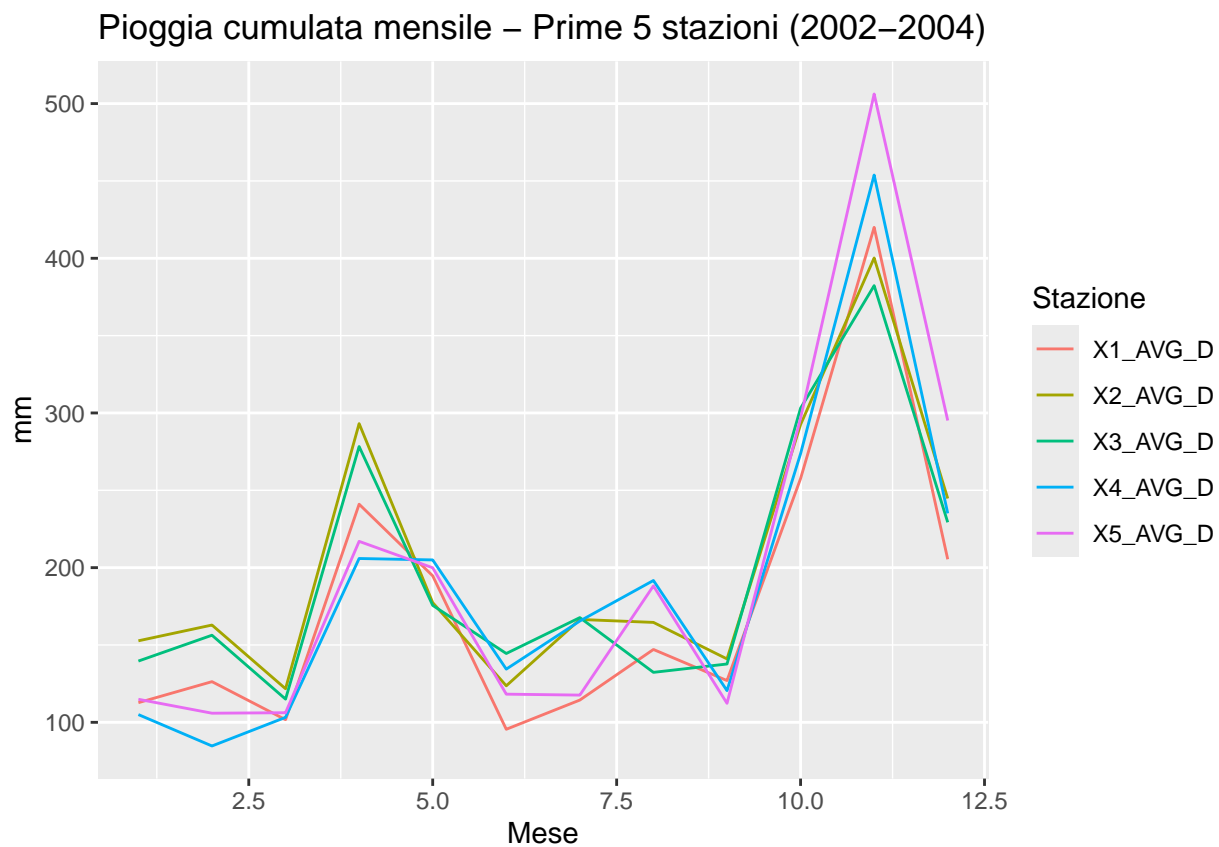
```
pioggia %>%
  select(Date, X1_AVG_D: X5_AVG_D ) %>%
  filter(year(Date) == 2002) %>%
  mutate(Mese = month(Date)) %>%
  pivot_longer(cols = -c(Date, Mese), names_to = "Stazione", values_to = "Pioggia") %>%
  group_by(Mese, Stazione) %>%
  summarise(Pioggia_cumulata = sum(Pioggia, na.rm = TRUE), .groups = "drop") %>%
  ggplot(aes(x = Mese, y = Pioggia_cumulata, color = Stazione)) +
  geom_line() +
  labs(title = "Pioggia cumulata mensile - Prime 5 stazioni (2002)", y = "mm")
```

Pioggia cumulata mensile – Prime 5 stazioni (2002)



*# Alternativa con pivot\_longer e molti anni*

```
pioggia %>%
  select(Date, X1_AVG_D:X5_AVG_D) %>%
  filter(year(Date) %in% c(2002, 2003, 2004)) %>%
  pivot_longer(cols = X1_AVG_D:X5_AVG_D, names_to = "Stazione", values_to = "Pioggia") %>%
  mutate(Mese = month(Date)) %>%
  group_by(Mese, Stazione) %>%
  summarise(Pioggia_cumulata = sum(Pioggia, na.rm = TRUE), .groups = "drop") %>%
  ggplot(aes(x = Mese, y = Pioggia_cumulata, color = Stazione)) +
  geom_line() +
  labs(title = "Pioggia cumulata mensile - Prime 5 stazioni (2002-2004)", y = "mm")
```



## Note finali

- Ricordati di salvare lo script.
- L'uso di commenti nel codice è apprezzato.
- Buon lavoro!