

# Hydrological Frequency Analysis

## Homework 1 Due Oct. 9, 2019

1. Fifty-nine years of hourly rainfall data at a rainfall stations are available (BBL.csv).
  - (1) Find the annual maximum series of 1, 2, 3, 6, 12, 24, 48, and 72-hour design durations. You need to record the time instances of the beginning and the end of the annual maximum data.
  - (2) Find the annual exceedance series of the rainfall data for the 24-hour design duration. [The minimum interevent time = 4 hours.]
2. Using the data in Problem 1, conduct the following analyses:
  - (1) Extract the rainfall data of individual storm events and record their beginning and ending hours. [Note: Ignore all hourly rainfalls which are less than 0.5 mm/hr.]
  - (2) Calculate the duration and total depth of each individual storm events.
  - (3) Plot the frequency histogram of the duration and total depth, respectively.
  - (4) Plot the scatter plot of (duration, total depth).
3. Random variable X has a Gumbel density of expected value 120 and standard deviation 36.
  - (1) Use the frequency factor approach to simulate a random sample of size 60 from X.
  - (2) Use R (rgumbel in the evd package) to simulate a random sample of size 60 from X.
  - (3) Plot and compare the empirical CDF of the above two samples. (plot.ecdf)

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> AMS
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8]
[1,] 46.0 55.5 81.5 129.7 196.0 238.6 365.9 438.2
[2,] 30.5 45.0 56.1 77.8 102.1 128.7 202.6 235.1
[3,] 37.8 74.5 109.4 171.5 189.7 280.5 323.9 324.8
[4,] 41.2 58.4 67.0 127.7 230.6 385.7 597.2 622.2
[5,] 30.0 54.8 70.2 89.9 146.3 200.8 249.2 278.1
[6,] 33.5 65.0 89.4 124.9 142.7 192.2 197.9 197.9
[7,] 51.0 85.0 113.0 220.8 308.3 357.5 433.4 490.1
[8,] 41.5 78.5 106.1 178.8 332.2 568.3 825.4 961.1
[9,] 56.1 103.1 150.5 285.9 497.2 655.3 895.7 942.7
[10,] 46.0 82.6 106.4 204.7 362.4 653.0 1251.1 1782.0

> BBL$Time[t(LOC)]# Beginning time of the annual maximum rainfalls expressed as yyyyymmddhh
 [1] 1960091715 1960091714 1960091713 1960080805 1960080802 1960080717 1960091516 1960091505
 [9] 1961080312 1961052107 1961052624 1961052623 1961091501 1961110222 1961110223 1961110201
[17] 1962082524 1962082524 1962082524 1962082522 1962080101 1962080510 1962080416 1962080315
[25] 1963051202 1963051202 1963091119 1963091115 1963091110 1963091024 1963091005 1963090920
[33] 1964082719 1964082719 1964061622 1964102407 1964102402 1964102316 1964102314 1964102314
[41] 1965072317 1965081901 1965081901 1965081823 1965081819 1965081808 1965081722 1965081722
[49] 1966090619 1966090619 1966090618 1966090615 1966090610 1966090601 1966090424 1966091305
[57] 1967101721 1967101720 1967101720 1967101804 1967101720 1967101714 1967101624 1967101619
[65] 1968093019 1968093018 1968093017 1968093018 1968093013 1968093001 1968092901 1968092809
[73] 1969080422 1969092624 1969100215 1969100215 1969100215 1969100215 1969100118 1969100117

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