

## Hydrological Frequency Analysis

### Homework 3 Due Nov. 20, 2019

1. Let  $X$  be a gamma random variable with scale parameter 100, and shape parameter 0.8.
  - (1) Generate 10,000 random samples of  $X$ , each of sample size 50.
  - (2) For each random sample in (1), estimate the scale and shape parameters by using the method of moments, the maximum likelihood method, and the method of L-moments.
  - (3) On the same graph, show estimates of the (scale, shape) parameter-pair by different methods.
  - (4) Calculate and compare the mean squared error of the three estimators.
  
2. Assuming the BBL annual maximum series of 1, 2, 3, 6, 12, 24, 48, and 72-hour durations can be characterized by the Pearson type III (PT3) distribution.
  - (1) Estimate the PT3 parameters by using the method of L-moments.
  - (2) For each of the eight design durations, find the rainfall amounts of 5, 20, 50, 100, and 200-year return periods.
  - (3) Fit the design rainfall depths obtained in (2) to the following equation:

$$\bar{i}(tr, T) = \frac{aT^m}{tr^c}$$

where  $\bar{i}$  represents the average intensity,  $tr$  is the duration (in minutes), and  $T$  represents the return period (in years). Show the  $\log(\bar{i}) \sim \log(tr)$  plot of different return periods.