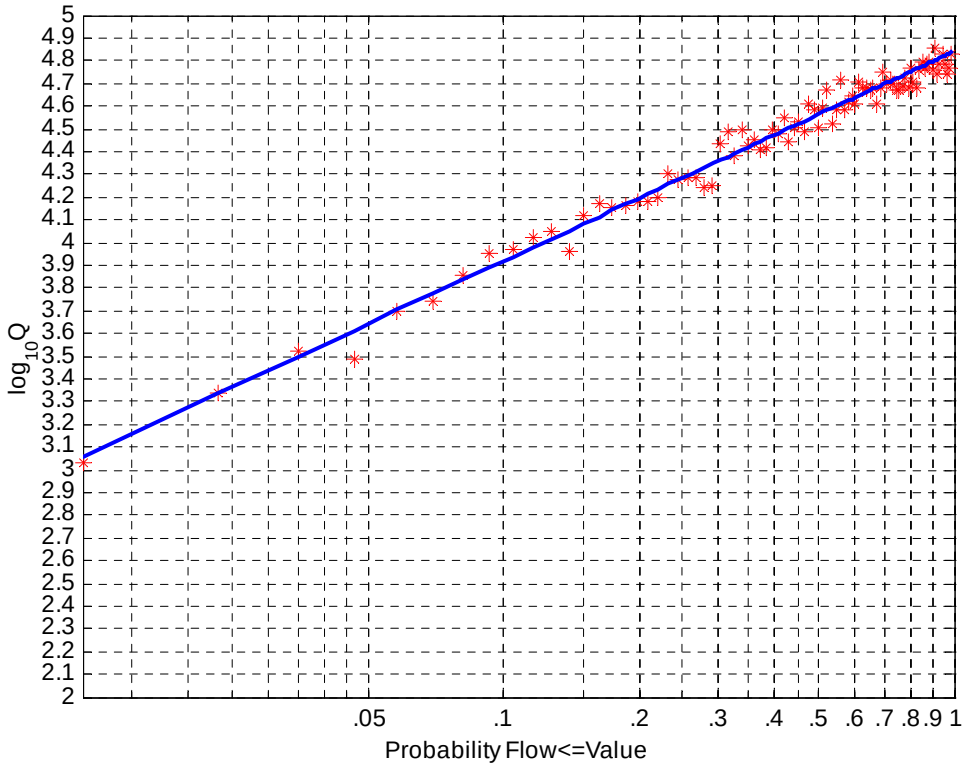
CE 103 Comprehensive Exam
From Xu Liang

1. The 10 based logarithm of annual peak discharge ($\log_{10}Q$) records (in cfs) of 85 years from a watershed in California can be fitted to a straight line on a normal distribution paper as shown in the Figure below. In following, please use the fitted line to answer all the questions.



(1) Which distribution below can be a good candidate for the annual peak discharge for the data shown in Figure 1?
(a). Normal (b) Log-Normal (c) Poission (d) Binomial (e) Exponential
(2) What is the probability that a flood will be equal to or greater than 19,950 cfs?
(3) What is the magnitude of flood with a return period of 50 years?
(4) What is the probability that the 50-year flood will occur only in the 5th and 10th year in the next 15 years?

2. In continuous time, the Muskingum routing equations were seen to be

$$\frac{dS}{dt} = I - Q$$

$$S = k[xI + (1-x)Q]$$

Assume you have an empty (*Q=0* at *t=0*) channel below a dam. The dam breaks and the release (input to the channel) is very high at the beginning and decreases with time. Assume the release *I(t)* can be described by a function,

$$I(t) = I_o e^{-\lambda t}$$

Derive the Muskingum routing expression for discharge *Q(t)* in the downstream channel given the inflow *I(t)* to be expressed above. Hint: The solution to

$$\frac{dY}{dt} + P(t)Y = g(t)$$

is

$$Y(t) = \frac{1}{\mu(t)}\left[\int \mu(t)g(t)dt + c\right]$$

where *c* is a constant, and

$$\mu(t) = \exp\left[\int P(t)dt\right]$$