53:078 PRINCIPLES OF HYDROLOGY
Quiz –Flood Probabilities

For an Iowa stream, the 1993 flood produced that largest peak discharge in the 21 year streamgage record. What is the estimated return period T (in years) for the 1993 flood (by the non-parametric method)?

$$\hat{T} = \frac{1}{\hat{p}} = \frac{N+1}{m} = \frac{21+1}{1} = 22 \text{ years}$$

For the same Iowa stream, the sample moments for the annual maximum flood series are:

$N = 21$
$\bar{x} = 2750$ cfs
$\hat{\sigma} = 1620$ cfs

The peak discharge for the 1993 flood was 8200 cfs. What is the estimated exceedance probability of the 1993 (by the parametric method)?

$$\hat{a} = \frac{\sqrt{6}}{\pi}\hat{\sigma} = \frac{\sqrt{6}}{\pi}(1620) = 1263.1 \text{ cfs}$$
$$\hat{b} = \bar{x} - 0.5772\hat{a} = 2750 - 0.5772(1263.1) = 2020.9 \text{ cfs}$$
$$\hat{F}(8200) = \exp\left[-\exp\left(-\frac{x-\hat{b}}{\hat{a}}\right)\right] = \exp\left[-\exp\left(-\frac{8200-1263.1}{2020.9}\right)\right] = 0.9682$$
$$\hat{p} = 1 - \hat{F}(8200) = 1 - 0.9682 = 0.0318$$

What is the 100-year return period peak discharge (the so-called 100-year flood)?

$$p = \frac{1}{T} = \frac{1}{100} = 0.01$$

$$\hat{q}(p) = \hat{b} - \hat{a}\ln\left(-\ln(1-p)\right)$$

$$\hat{q}(0.01) = 2020.9 - 1263.1\ln\left(-\ln(1-0.01)\right) = 7831.3 \text{ cfs}$$