Problem one:

a) Watershed circularity ratios

First definition:

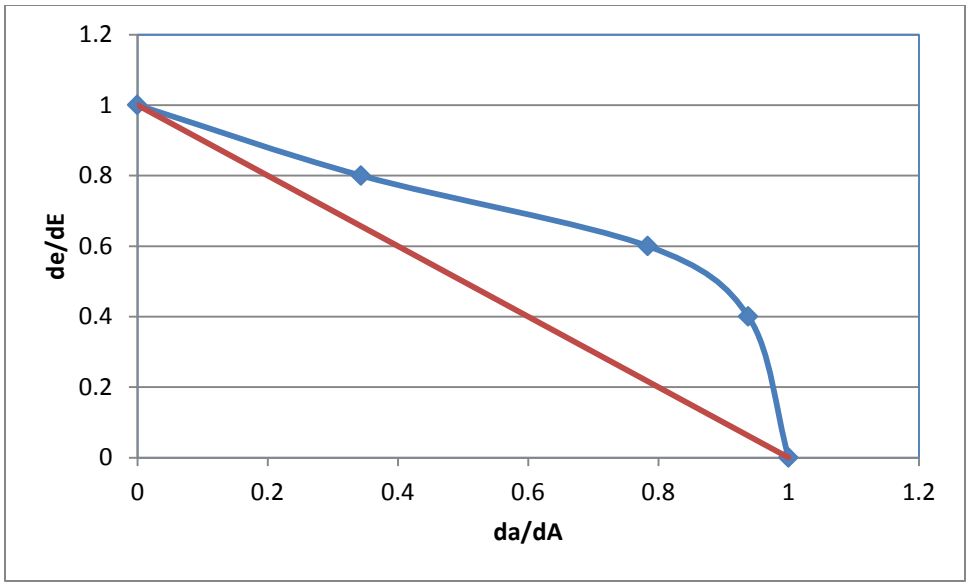
$A = 1618.75\ km^2$

$P = 234.37\ Km$

$$FC = \frac{P}{(4\,\pi\,A)^{0.5}} = 1.64$$

Sections in the watershed	boxes	Area of a box	Area
A1	22.25	25	556.25
A2	28.5	25	712.5
A3	10	25	250
A4	4	25	100
Sum	64.75	25	1618.75

elevation	Area	a/A	de/dE
70	1518.75	0.938224	0.4
80	1268.75	0.783784	0.6
90	556.25	0.343629	0.8
100	0	0	1



$$\text{Ld} = \sqrt{1^2 + 1^2} = \sqrt{2}$$

$$\text{Dm} = \sqrt{(0.9 - 0.78)^2 + (0.5 - 0.25)^2} = 0.277$$

$$\text{Fp} = \frac{\text{Dm}}{\text{Ld}} = \frac{0.277}{\sqrt{2}} = 0.2$$

Applying the Trapezoidal rule we have:

$$\text{Ha} = 0.706$$

Problem Two:

First Watershed

$$\int_0^{200} kx/200 \, dx + \int_{200}^{800} k\left(1 - \frac{x-200}{600}\right) dx = 1$$

$$K = 0.0025$$

$$P\ (Q>300) = \int_{300}^{800} 0.0025\left(1 - \frac{x-200}{600}\right) dx = 0.5208$$

a. P (Q<400) = 1 – P (Q>400) = 1 - $\int_{400}^{800} 0.0025(1-\frac{x-200}{600})dx$ = 0.6785

b. P (Q=200) = 0

c. P (100<Q<450) = 1- $\int_{0}^{100} 0.0025\frac{x}{200})dx$ - $\int_{450}^{800} 0.0025(1-\frac{x-200}{600})$ dx
= 1 – 0.0625 – 0.2552
= **0.68**

Second Wateshed

$\int_{0}^{300} kx/300$ dx + $\int_{300}^{700} k(1-\frac{x-300}{400})$ dx =1

K = 0.00285

a. P (Q>300) = $\int_{300}^{700} 0.00285(1-\frac{x-300}{400})$ dx = 0.5714

b. P (Q<400) = 1 – P (Q>400) = 1 - $\int_{400}^{700} 0.00285(1-\frac{x-300}{400})dx$ = **0.6667**

c. P (Q=200) = continuous probability distribution.

d. P (100<Q<450) = 1- $\int_{0}^{100} 0.0025\frac{x}{200})dx$ - $\int_{450}^{700} 0.00285(1-\frac{x-300}{400})$ dx
= 1 – 0.047 – 0.223 = **0.73**

Problem Three)

Rank (i)	Year	T	P (%)	log(T)
1	1954	82.5	5.2632	0.72125
2	1959	80.6	10.5263	1.022276
3	1956	80.4	15.7895	1.198368
4	1955	80.1	21.0526	1.323306
5	1968	79.6	26.3158	1.420217
6	1957	79.5	31.5789	1.499397
7	1970	79.1	36.8421	1.566344
8	1960	78.9	42.1053	1.624337
9	1958	78.9	47.3684	1.675489
10	1963	78	52.6316	1.721247
11	1965	77.7	57.8947	1.762639
12	1971	76.7	63.1579	1.800428
13	1966	76.6	68.4211	1.83519
14	1969	76.2	73.6842	1.867374
15	1964	76.1	78.9474	1.897338
16	1962	75.7	84.2105	1.925366
17	1967	74.6	89.4737	1.951695
18	1961	74.1	94.7368	1.976519

After plotting on the probability paper we would have:

a) $P = \frac{1}{t} = \frac{1}{10} = 0.1 \text{ x}100 = 10\%$
Using the graph we obtain Log (T) = 4.3 → T = 81.00 F

b) Log (83) = 1.91
Using the graph we obtain P = 1.7 %

c) Log (72) = 1.85
Because we need a probability which will not exceed 72, so we would have:
Using the graph we obtain P = 100 - 99.69=0.04 %

Problem Four)

Year	Discharge, Q	Log(Q)
1935	38500	4.585461
1936	179000	5.252853
1937	17200	4.235528
1938	25400	4.404834
1939	4940	3.693727
1940	55900	4.747412
1941	58000	4.763428
1942	56000	4.748188
1943	7710	3.887054
1944	12300	4.089905
1945	22000	4.342423
1946	17900	4.252853
1947	46000	4.662758
1948	6970	3.843233
1949	20600	4.313867
1950	13300	4.123852
1951	12300	4.089905
1952	28400	4.453318
1953	11600	4.064458
1954	8560	3.932474
1955	4950	3.694605
1956	1730	3.238046
1957	25300	4.403121
1958	58300	4.765669
1959	10100	4.004321
1960	23700	4.374748
1961	55800	4.746634
1962	10800	4.033424
1963	4100	3.612784
1964	5720	3.757396
1965	15000	4.176091
1966	9790	3.990783
1967	70000	4.845098
1968	44300	4.646404
1969	15200	4.181844
1970	9190	3.963316
1971	9740	3.988559
1972	58500	4.767156
1973	33100	4.519828
1974	25200	4.401401
1975	30200	4.480007
1976	14100	4.149219

1977	54500	4.736397
1978	12700	4.103804
Average		4.274277
Standard deviation		0.402679
Skewness		-0.06722

Lognormal:

For five years, $K_5 = 0.842$ and for 50 years we would have $K_{50} = 2.054$

$$y_T = \bar{y} + KS_y = 4.27 + 2.054 * 0.4026 = 5.101$$

$$x_{50} = 10^{5.101} = 126.3\ cfs$$

and for 5 year:

$$y_T = \bar{y} + KS_y = 4.27 + 0.842 * 0.4026 = 4.61$$

$$x_{50} = 10^{4.61} = 41060\ cfs$$

log pearson III:

Considering the skewness:

$C_s = -0.0696$

$K_{50} = 2.016$

$$y_T = \bar{y} + KS_y = 4.27 + 2.016 * 0.4026 = 5.086$$

$$x_{50} = 10^{5.086} = 121990\ cfs$$

and for 5 year:

$$y_T = \bar{y} + KS_y = 4.27 + 0.845 * 0.4026 = 4.61$$

$$x_{50} = 10^{4.61} = 41170\ cfs$$