

# Nonparametric statistics: Practical session I

1. Suppose  $X$  has the continuous distribution  $F$ . Define  $Y = F(X)$ . Show that  $Y$  has  $U(0, 1)$  distribution. Hence or otherwise, find the transformation  $Y = g(X)$  such that  $Y$  has  $U(0, 2)$  distribution where  $X$  has the density function  $f(x) = 2(1 - x)$ ,  $0 < x < 1$ .
2. Let  $T_1, T_2, \dots, T_k$  denote the lifetimes of the  $k$  components of a series system. It is assumed that all the components are independent and identically distributed and the common distribution functions is  $F(\cdot)$ . Express the system lifetime in terms of its component lifetimes and hence obtain the distribution of the system lifetime.
3. Generate 10 observations from exponential distribution by choosing appropriate parameter value. Obtain the corresponding ordered observations and their ranks. Also obtain the median and range based on the simulated data.
4. The placement of long-distance telephone calls through a certain switchboard is believed to be a random process. The first 10 calls after 2 pm on a particular day occurred at 2 : 05, 2 : 07, 2 : 15, 2 : 21, 2 : 22, 2 : 33, 2 : 43, 2 : 46, 2 : 50, 2 : 56. Obtain the empirical distribution of the successive times between the calls. (If  $T_1, \dots, T_n$  are times then the successive times are  $T_2 - T_1, T_3 - T_2, \dots, T_n - T_{n-1}$ ).
5. The emissions of nitrous oxide from the last year's model of automobile have been measured for thousands of cars and found to be approximately normal with mean 5.6 and standard deviation 1.2. Twelve of this year's model automobile have been tested with the results 4.8, 6.2, 6.0, 5.9, 6.6, 5.5, 5.8, 5.9, 6.3, 6.6., 6.2, 5.0. Does this year's model appear to have the same distribution as last year's model?
6. Let  $F_0(x)$  be the discrete uniform distribution with equal probabilities  $1/5$  at the five points  $x = 1, 2, 3, 4, 5$ . Suppose a random sample of 10 with ordered observations 1, 1, 1, 2, 2, 2, 3, 3, 3, 3 is drawn from some population. Test whether this sample comes from the distribution given by  $F_0(x)$  or not.