

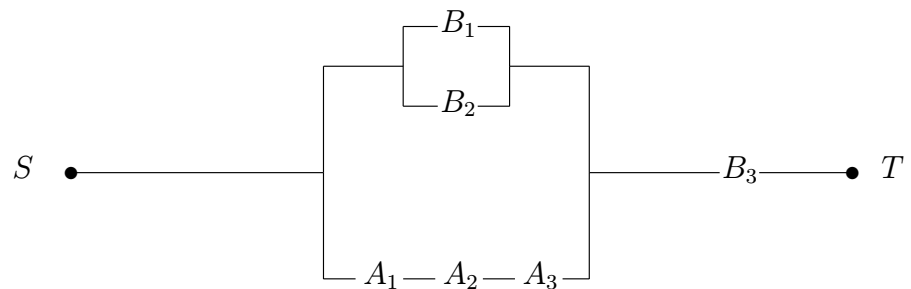
5. A particular application accesses two computer files which are downloaded sequentially. The downloading times, T_1 and T_2 of the two files are modelled as independent normal random variables with means μ_1 and μ_2 and *known* standard deviations $\sigma_1 = 0.3$ and $\sigma_2 = 0.4$ respectively. The total downloading time is given by $T = T_1 + T_2$.
- (i) Initially it is assumed that $\mu_1 = 2$ seconds and $\mu_2 = 3$ seconds. Find,
 - (a) $P(T_1 > 2.6)$.
 - (b) $P(T_2 > 4)$.
 - (ii) To assess the accuracy of the reported means, a sample of 50 downloading times is measured for each file giving sample means of 2.01 and 3.97 for T_1 and T_2 respectively.
 - (a) Find 95% confidence intervals for μ_1 and μ_2 .
 - (b) Comment on these confidence intervals in light of the initial assumptions in part (i).
 - (c) What is the distribution of the total downloading time?
 - (d) Determine a 95% confidence interval for the mean total downloading time.
 - (e) Under the assumptions in part (i) determine the probability that the mean total downloading time is greater than the upper bound of the confidence interval calculated in part (ii)(d). Comment on your result.

6. A particular component is obtained from sources A or B , with 90% chance of being obtained from source A and the remaining 10% chance from source B . The lifetimes, T_A and T_B of components of type A and B in hours, have probability density function

$$f(t) = \lambda e^{-\lambda t} \quad t > 0,$$

with $\lambda = 0.2$ and $\lambda = 0.5$ for components from sources A and B respectively.

- (i)
 - (a) Determine the reliability functions and hazard rates associated with T_A and T_B .
 - (b) Determine the reliability of each type of component at 2 hours.
 - (c) Determine the reliability of a randomly selected component at 2 hours.
 - (d) Given that a component is still operating at 2 hours, what is the probability that it was obtained from A ?
- (ii) A system is made up using components, A_1, A_2, A_3 from source A and B_1, B_2, B_3 from source B . The system functions if there is a path of non-defective components between S and T .



- (a) Assuming that the lifetimes of all components are independent, determine the reliability of the system at 2 hours.
- (b) Determine if it is possible to replace the parallel components B_1 and B_2 by a single component obtained from source A without decreasing the reliability of the system at 2 hours. Justify your answer.