Practise Class 11: Designs – Answers

Q1: Break the subsets into groupings of 3 lots of 4 subsets each. Each grouping is given to a household and the detergents within the 4 subsets are compared over 4 days. The detergents in the first subset are compared on day 1, those in the second subset on day 2 and so on.

As an extra feature the 4 subsets could be chosen so that all brands are included at least once.

Q2: $r = \lambda \left(\dfrac{v-1}{k-1} \right), r = \dfrac{bk}{v}; \ 3 \neq 1 \times \dfrac{8-1}{2-1} = 7.$

Q3: $b = 10, v = 6, r = 5, k = 3, \lambda = 2; \ 5 = 2 \times \dfrac{6-1}{3-1}; \ 5 = \dfrac{10 \times 3}{6}.$

Q4: Write down the incidence matrix and its complement by yourself.
The complement represents a design with parameters $b = 10, v = 6, r = 5, k = 3, \lambda = 2.$

Q5: (a) Hint: Note that $\det(M^T M) = \det(M^T)\det(M) = \left(\det(M)\right)^2.$
(b) Hint: This follows from the definition of M.
(c) Hint: Use (b) and $M^T M = (k - \lambda)I + \lambda J.$