

Give appropriate justifications for your answers.

- For each of the following parameter values either determine the remaining parameters and give an example of a (v, b, r, k, λ) -BIBD with these parameters, or show that no such BIBD exists.
 - $r = 4, k = 11, \lambda = 2$.
 - $b = 30, r = 6, k = 5$.
 - $v = 46, r = 10, \lambda = 2$.
- Consider a symmetric balanced design with parameters (v, b, r, k, λ) with $v = 40$. Show that $\lambda \in \{4, 18, 38\}$. (You do not have to construct BIBDs with these parameters.)
- Consider a BIBD with parameters (v, b, r, k, λ) .
 - Show that if $\lambda = 2$, then $v \leq \binom{r}{2} + 1$.
 - Show that if $\lambda = 2, r = 7$, and $k > 1$, then $v = 15$.
(Again, you do not have to construct BIBDs with these parameters.)
- Prove that Construction 4.31 in the course notes works; in other words, show that if a line ℓ and all points incident to ℓ are removed from a projective plane, the result is an affine plane.
- Construct a set of 6 MOLS of order 7 (you do not need to write them out in full, it suffices to give a formula for the entry in position i, j and show that this is a set of MOLS).
- Consider the following partially filled latin square

1	2	3	4	5
2	1	5	3	4

- Find a completion.
- Show that there is no completion which has an orthogonal mate.
Hint: use Theorem 4.63.