1. What is wrong with the following 'proof' that if S is a body in $\mathbb{R}^3$ then $|S|^2 \leq |S_{12}||S_{23}||S_{31}|$: if we let $T = S \times S \subset \mathbb{R}^6$, then $|S|^2 = |T| \leq |T_{12}||T_{34}||T_{56}| = |S_{12}||S_{31}||S_{23}|$.

2. Let $A \subset \mathcal{P}(X)$ be a set system whose projection onto each of the sets $\{1,2,3\}, \{2,3,4\}, \ldots, \{n-2, n-1, n\}, \{n-1, n, 1\}, \{n, 1, 2\}$ has size less than 8. Explain why when n is a multiple of 3 it is trivial that $|A| \leq 7^{n/3}$, and then prove that in fact this holds for every value of n.

3. Let $Y_1, Y_2, \ldots, Y_r \subset [n]$ be sets that do *not* form a uniform cover of $[n]$. Show that knowledge of $|S_{Y_1}||S_{Y_2}|\ldots|S_{Y_r}|$ does not imply any upper bound on $|S|$.

4. Let A be a family of graphs on n vertices such that the intersection of any two members of A has no isolated vertices. Show that, for n even, A cannot be larger than the family of all graphs containing a given matching.

5. Let S and T be bodies in $\mathbb{R}^n$, and let B and C be boxes verifying the Bollobás-Thomason box theorem for S and T respectively. Give an example with $S \subset T$ such that B and C cannot be chosen to satisfy $B \subset C$.

$^+$6. Let A be a family of graphs on n vertices such that the intersection of any two members of A has a Hamilton cycle. How large can A be?