Ali Awari – aka87

Homework #4

* Let *S* be a finite set with n elements.
* We will show how many possible functions exist between a mapping: f: S 🡪 S
* Let *x* be an element in *S,* y be an element in the image of f.
* There are *y*, possible elements for *x* to map to with f.
* Because x must map to a y for S to be considered a function, f is surjective
* The cardinality of S is equal to itself
* Therefore there are: **nn** different mappings
* Suppose that fis injective
* If S has n elements, this means the image of f has **at least** n elements
* The image of f is contained in S, so it has **at most** n elements
* Therefore the image of f has **exactly** n elements, i.e. surjective.
* Suppose that f is surjective
* For each y in S, there is an x, such that y = f(x)
* We define a function g, such that g(y) = x
* f(g(y)) = y
* g is injective, therefore bijective
* f is an inverse of g, so it is also bijective, therefore injective.
* **n!** bijections

**Part 2.**

* Because mapping two sets creates a symmetric group there are **n!** possible orientations.
* You would only need three functions, to generate all other possible combinations.
* {f(x), g(x), g(f(x))}