g) Not a covering.

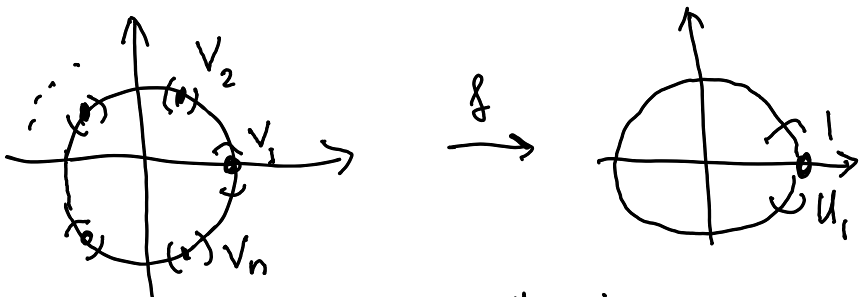
Applying prob 5, note that for $0 \in \mathbb{C}$ we have $|f^{-1}(0)| = 0$ for $f : \mathbb{C} \to \mathbb{C}$, $z \mapsto z^n$, $n > 0$.

But $|f^{-1}(z)| = n$ if $z \neq 0$.

(For $n < 0$, f is not even defined at $z = 0$; for $n = 0$, it is just the constant map, clearly not a covering.)

b i) When
$f: S^1 \to S^1$, $S^1 = \{z \in \mathbb{C} \mid |z| = 1\}$
$z \mapsto z^n$

e.g. if $z = 1$, then $f^{-1}(1)$ has n pre-images, situated as:



all solutions to $w^n = 1$
i.e. these are nth roots of unity.

So if U_1 is a sufficiently small arc in S^1 around 1, then the pre-image of that arc consists of disjoint small arcs around the roots and f restricted to them is a homeomorphism.

We get a similar structure for other points of S^1 in the target space.