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CW complexes

(one reference is Hatcher, Algebraic Topology, Appendix p. 519). Let $n \in \mathbb{Z}_{>0}$.

Define a topological space $(D^n, \mathcal{T}^{std}_{D^n})$ by

$$D^n = \{(x_1, \ldots, x_n) \in \mathbb{R}^n \mid x_1^2 + \cdots + x_n^2 \le 1\}$$

with $\mathcal{T}^{std}_{D^n}$ the subspace topology of $(\mathbb{R}^n, \mathcal{T}^{std}_{\mathbb{R}^n})$.

Define a topological space $(S^{n-1}, \mathcal{T}^{std}_{S^{n-1}})$ by

$$S^{n-1} = \{(x_1, \ldots, x_n) \in \mathbb{R}^n \mid x_1^2 + \cdots + x_n^2 = 1\}.$$

with $\mathcal{T}^{std}_{S^{n-1}}$ the subspace topology of $(\mathbb{R}^n, \mathcal{T}^{std}_{\mathbb{R}^n})$.

Let $(X, \mathcal{T}_X)$ be a topological space and let

$$g : S^{n-1} \to X \text{ be a continuous map.}$$

Define $(D^n \sqcup_g X, \mathcal{T}_{D^n \sqcup_g X})$ by

$$D^n \sqcup_g X = \frac{D^n \sqcup X}{\langle g(s) = s \mid s \in S^{n-1} \rangle}$$

with $\mathcal{T}_{D^n \sqcup_g X}$ the quotient topology.

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The collection of (finite) <u>CW complexes</u> is the collection of topological spaces determined by the conditions

(a) pt is a CW-complex

(b) If $(X, \mathcal{T}_X)$ is a CW-complex and $n \in \mathbb{Z}_{>0}$ and $g: S^{n-1} \to X$ is a continuous function then

$$(D^n \sqcup_g X, \mathcal{T}_{D^n \sqcup_g X}) \text{ is a CW-complex.}$$