

Comprehension questions

PROBLEM 30.1. *In the picture below, suppose the shaded parts have been decomposed into triangles, so as to make the whole thing a complex. Compute its Betti numbers.*

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PROBLEM 30.2. *Draw a planar complex with $b_0 = 3$, $b_1 = 3$.*

PROBLEM 30.3. *The disjoint union of two abstract complexes is defined by simply combining their vertices, edges, and triangles (considered as distinct). If K is the disjoint union of K_1 and K_2 , how are their Betti numbers related, and why?*

PROBLEM 30.4. *Find a way to make a Moebius band as an abstract complex, and compute its Betti numbers. (Please remember, in our definition of complex, there can't be two different edges which have the same endpoints.) Computer assistance in computing ranks of matrices is permitted.*

PROBLEM 30.5. *In the plane, take the points $v_1 = (0, 0)$, $v_2 = (1, 0)$, $v_3 = (0, 1)$, $v_4 = (1, 1)$. What are the Vietoris-Rips complexes at scales $\sigma = 0.7$, $\sigma = 1.1$, $\sigma = 1.5$?*

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