Convexity

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questions for the exam preparation
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general questions

1. How would you categorize the different topics we discussed in class?
2. How are they/some of them related?
3. For each topic, what are the main results?
4. Did we use previous results to prove them?
5. What are different techniques that we used (maybe several times)?
6. Are there some exercises showing some nice results that might be useful?
7. Which properties do the different concepts we discuss have? (Also look on the exercises.)
8. Looking on different theorems, what happens if you drop some of the demanded properties?
9. ...

on convex bodies

1. How is a convex body defined?
2. Are there different characterizations for convexity?
3. For which statements did we need, in addition, central symmetry?
4. Which tricks did we use when the convex body was centrally symmetric?
5. Why do ellipsoids take an important role under the class of convex bodies?
6. ...

on lattices

1. What is a lattice?
2. What is the dual lattice?
3. How are different bases of a lattice related?
4. Can any lattice vector be contained in a basis?
5. What special bases do you know?
6. Which problems related to lattices did we see?

7. Can we solve them, or maybe approximate them?
8. ...

on polyhedra

1. What is a polyhedron? What is a polytope?
2. What is a cone? What is a polyhedral cone? What is a finitely generated cone?
3. How are they related? How can you describe them?
4. What are extreme points of a polyhedron? What are different characterizations? (Again, look at the exercises.)
5. What are the facets and how are they related to the describing system of inequalities?
6. ...

on voronoi cells

1. What is the Voronoi Cell of a lattice?
2. What do you know about the Voronoi Cell?
3. How did we determine the Voronoi Cell?
4. How was a voronoi cell useful to find a closest vector?
5. ...

on LLL reduced bases

1. How was an LLL-reduced basis defined?
2. How is the Gram-Schmidt Orthogonalization related to the determinant of the lattice?
3. How is the Gram-Schmidt Orthogonalization related to the length of a shortest vector?
4. ...

on concentration of measure

1. What is a Gaussian?
2. Which inequalities did we see for probabilities and expected values?
3. Which tricks did we use here?
4. Where is most of the measure on a Sphere?
5. Considering a Gaussian in n dimensions as a density function, where is most of the measure now?
6. ...

Are there other topics we discussed? We do not guarantee that these questions cover the whole lecture!

We hope you will have a nice Christmas and the preparations for the exam work well. For any questions, you can contact the assistant at any time: christoph.hunkenschroder@epfl.ch.