KIT-Department of Informatics
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Answer sheets for the exam

Robotics II: Humanoid Robotics

on January 25, 2019, 18:00 – 19:00

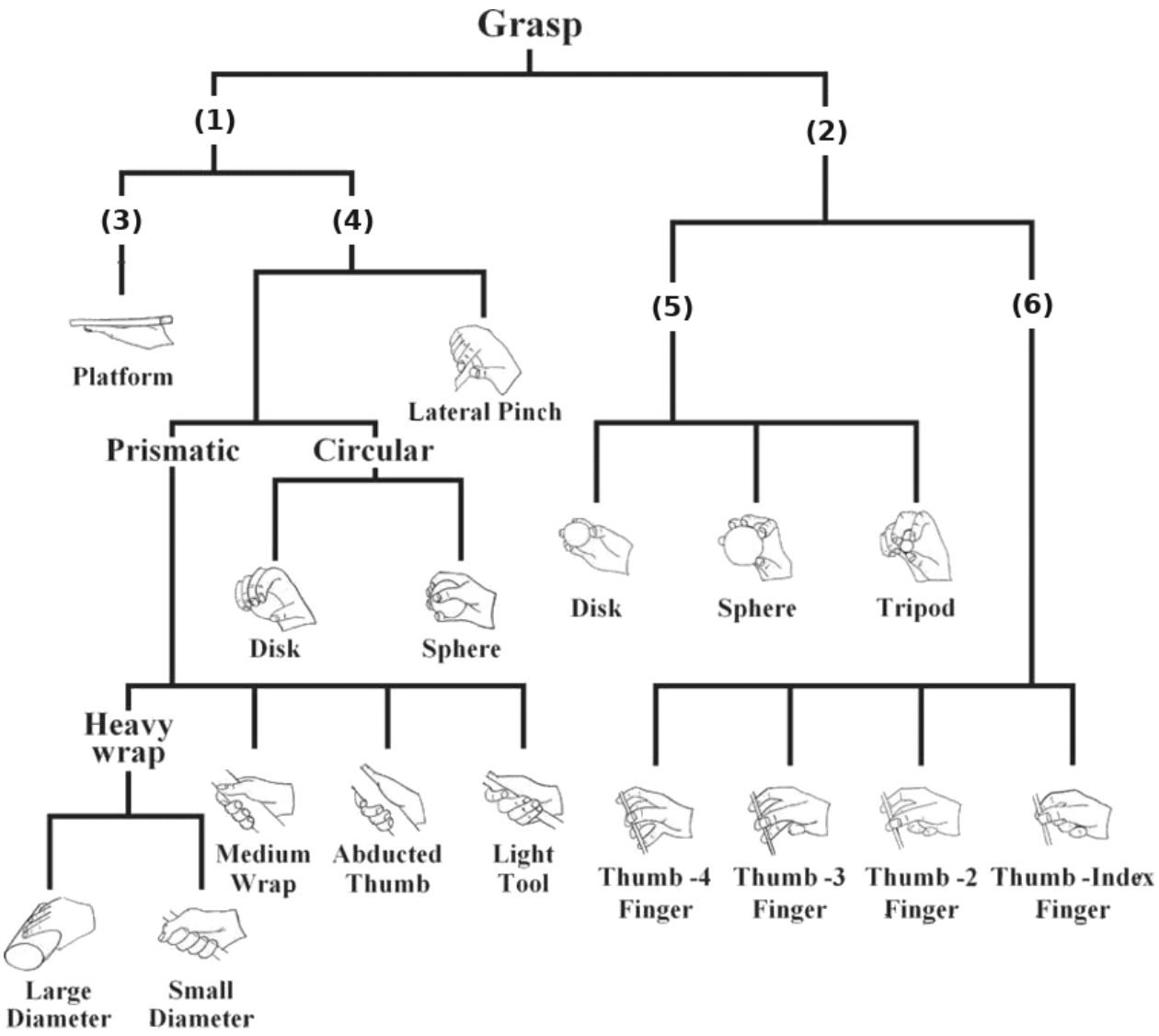
Family name:	Given name:	Matriculation number:

Exercise 1	out of 10 points
Exercise 2	out of 7 points
Exercise 3	out of 8 points
Exercise 4	out of 12 points
Exercise 5	out of 8 points

Total:	

	Grade:

Solution 1 *Grasping*



1. Category labels in the *Cutkosky Grasp Taxonomy*:

   (1)

   (2)

   (3)

   (4)

   (5)

   (6)

2. Difference between a *grasp taxonomy* and a *manipulation taxonomy*:

3. Definition of *prehensile manipulation*:

4. Difference between *motion* and *motion at contact*:

5. Information stored in a grasp database:

6. Explain if and how a grasp database is used for grasping

   (a) Known objects:

   (b) Familiar objects:

   (c) Unknown objects:

Solution 2 *Grasp Synergies*

1. Eigengrasp vector $\mathbf{e}_1$:

2. Mechanical realization of $z_1 = \frac{1}{2}(y_{11} + y_{12})$:

3. Amplitude vector $\mathbf{a}$:

Solution 3 *Active Perception*

1. (a) Visual inputs:
   i. Restriction of the search space:

   ii. Validation of object candidates:

   (b) Method for the restriction of the search space:

   (c) Method for the validation of object candidates:

2. (a) Goal of saccade generation:

(b) Representation of saliency:

3. (a) Two layers in the transsaccadic memory and differences between them:
   - Layer 1:
   - Layer 2:

(b) Consistency of scene and memory:

Solution 4 *Haptics*

1. Purpose, attractive and repellent regions:

2. Potential field equation:

3. Geometric feature:

4. Four filtering criteria:

5. Equation of the virtual force $F(\mathbf{x})$:

6. Virtual force for one potential:

7. Virtual forces values $F_1(\mathbf{0}), F_2(\mathbf{0})$ and $F(\mathbf{0})$ for the given potentials:

Solution 5 *Imitation Learning*

1. Correspondence problem:

2. Mirror neurons:

3. Passive imitation:

   Active imitation:

4. Idea of the Master Motor Map (MMM):

5. Parameters of the kinematic model:

   Parameters of the dynamic model: