

# T-106.270 Basic Course in Programming T3

## Examination, May 16th, 2003

1. (12p) Give a short answer to following questions (max. 100 words per question):
  - (a) What different forms of polymorphism are used in programming languages?
  - (b) What is a *static class* and a *dynamic class*? How are these terms related to static and dynamic typing?
  - (c) What is a design pattern? Give an example of a design pattern?
  - (d) What is the difference between a *homogeneous collection* and a *heterogeneous collection*? What programming language mechanisms help in the implementation of homogeneous and heterogeneous collections?
  - (e) What is the difference between a subclass and a subtype? Why compilers use the subclass relationships instead of subtype relationships to verify the validity of assignments?
  - (f) In your opinion, what are the most important differences between C++ and Java?
2. (6p) Write an essay on multiple inheritance. Tell what multiple inheritance is, what are its benefits, and what problems arise from multiple inheritance in object-oriented programming and in the implementation of an object-oriented language. How can multiple inheritance be mimicked in languages that do not contain it, for example, in Java.
3. (6p) What are *cohesion* and *coupling* of classes? Below is a list of some forms of coupling and cohesion. Describe what they mean and when they occur. Are they particularly good or bad forms? For bad forms, tell how they could be avoided.
  - (a) Data cohesion.
  - (b) Temporal cohesion.
  - (c) Communication cohesion.
  - (d) Internal data coupling.
  - (e) Parameter coupling.
  - (f) Control (or sequence) coupling.
4. (6p) Write an essay on memory management in object-oriented languages.