

## Review of the first 14 lectures

The exam is open book and open notes. Calculators or laptop computers are not allowed. To prepare for the exam you must organize your course materials to be ready for fast consultation. There will be no time to study the notes. **The exam takes place in our regular classroom SH 0220.** Without computer, the questions on the exam will be more conceptual than otherwise. The questions below are just samples of the type of question you may expect.

1. Illustrate with an example how you can link one variable (say  $a$ ) to another variable (say  $b$ ): if the value of  $b$  changes, then also the value of  $a$  changes.
2. Concerning the evaluation of a polynomial in one variable
  - (a) What is the best way to evaluate a *dense* polynomial?  
(*dense* = all monomials have a nonzero coefficient)
  - (b) What is the best way to evaluate a *sparse* polynomial?  
(*sparse* = only few monomials have a nonzero coefficient)

In both cases, illustrate your answer with examples.

Compare the methods you propose with the straightforward method to evaluate a polynomial.

3. How can you see in Maple whether a function is part of the kernel, or written in the language of Maple.
4. What is the difference between `evalf` and `evalhf`? When do we use `evalf` and when `evalhf`? When does the difference really start to matter? Illustrate with examples.
5. Why is the command `evaln` needed? Illustrate with a good use.
6. Why can Maple not simplify  $\sqrt{x^2}$  directly to  $x$ ? Illustrate with an example.
7. What is the difference between an attribute and a property in Maple?  
Give an illustration of a good use of an attribute. Give an illustration of a good use of a property.
8. Give three different good uses of the right quotes.  
What is the use of left quotes?
9. Give two examples of good uses of the alias command.
10. When do we use `writeto` and when do we use `writedata`? Give an illustration of appropriate uses of these commands.
11. Give an example of a polynomial in two variables where the pure lexicographic order differs from the total degree order.
12. Give a finite field (i.e., a prime  $p$  which defines  $\mathbb{Z}_p$ ) so that the polynomial  $x^2 + 3$  factors over this field.
13. Explain the difference between `factor` and `Factor`.  
Why is there a need for two versions of a factorization command?

14. Explain the difference between the exact, symbolic, and numerical factorization of a polynomial in one variable into a product of linear factors.

For each type of factorization, give the typical Maple commands.

Give two examples of polynomials and their factorizations to illustrate

- (a) a case when the three types of factorizations are the same;
- (b) a case when the three types of factorizations are different.

15. Consider the polynomial  $p$ ,  $p := x*y - 7*x + y$ ;

- (a) Consider the output of `dismantle(p)`:

```
SUM(7)
  PROD(5)
    NAME(4): x
    INTPOS(2): 1
    NAME(4): y
    INTPOS(2): 1
  INTPOS(2): 1
  NAME(4): x
  INTNEG(2): -7
  NAME(4): y
  INTPOS(2): 1
```

Draw the directed acyclic graph to show the internal representation of the polynomial  $p$ .

- (b) Explain why  $q := \text{subs}(1 = -1, p)$ ; defines  $q$  as  $-\frac{1}{xy} - 7x - y$ .

16. Explain why Maple does not normalize rational expressions automatically. Give a good illustration of your answer.
17. Why are normal forms so important to symbolic computation? Illustrate with an example.
18. Concerning polynomials in one variable, what is the difference between the canonical form and a normal form?
19. Explain the symbolic and numerical way to test whether two expressions are the same.
20. What is the difference between `algsubs` and `subs`? Give an example where `algsubs` is needed (instead of `subs`) and another example where `subs` is needed (and where `algsubs` makes no sense).

Also review the 75 homework assignments at the end of each lecture, and see whether you understand the solutions to the quizzes.

**Please note the policy on skipping exams:** If an exam is missed, then greater weight will be placed on the final exam, especially on the material covered on the missing exam. **What this means is** that if you decide not to take one midterm exam, your final exam will be weighted for one hundred points more. **What it does NOT mean is** that you can drop the score of a midterm exam. If you take the midterm, then your score counts. So, please be prepared when you show up for the exam.