

Review of the first 14 lectures

The exam is open book and open notes. 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 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. How can you see in Maple whether a function is part of the kernel, or written in the language of Maple.
3. 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.
4. Why can Maple not simplify $\sqrt{x^2}$ directly to x ? Illustrate with an example.
5. Give three different good uses of the right quotes. What is the use of left quotes?
6. Give two examples of good uses of the alias command.
7. 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.
8. Give all Maple commands to write $e^{I\pi k}$ as $\cos(\pi k) + I \sin(\pi k)$.
9. Explain the difference between `factor` and `Factor`. Why is there a need for two versions of a factorization command?
10. Generate optimized C code to evaluate $p = 79x^{298} + 56x^{205} + 49x^{164} + 63x^{121} + 57x^{119} - 59x^{42}$. How many arithmetical operations are needed to evaluate p (following the optimized code)? Compare with the cost of a direct evaluation of p .
11. Explain the difference between the exact symbolic and approximate numeric 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 where the factorizations are the same;
 - (b) a case where the factorizations are different.
12. Consider the polynomial $p = x^3 - x - 2$ and give all Maple commands following questions:
 - (a) to write p as an **exact** product of linear factors, with exact complex numbers;
 - (b) to compute a **numerical** factorization of p over the complex numbers;
13. 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 $-\frac{1}{xy} - 7x - y$.

14. What equation(s) should a and b satisfy, so that $p = a * x^3 + b * x + 5$ is divisible by $x + 1$?
15. Explain why Maple does not normalize rational expressions automatically.
Give a good illustration of your answer.
16. Give all Maple commands to transform $(x - y)(x + y)$ into $(x + y)x - (x + y)y$.
17. Explain the symbolic and numerical way to test whether two expressions are the same.
18. 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 homework assignments and make sure you understand the problems of the quizzes.