Review of parts three and four of the course

In part three of the course we saw how to define functions and explored Maple's capabilities in differentiation and integration. In the fourth and final part of Maple we discussed Maple's data structure and went over solving equations.

Observe that the final exam does not happen in a computer lab, but in a regular room. Without computer, the exam will not require the availability of Maple and MATLAB, but will be a bit more conceptual than otherwise. The exam is still open book and open notes. Calculators or laptop computers are not allowed.

1. Why is it better to use the piecewise command in Maple, rather than to implement the piecewise function with an if-then-else statement?

2. What is the difference between unapply and the arrow operator?

   When do we better use the unapply (instead of the arrow operator to define a function)?

   Suppose the unapply would not exist, can we then achieve the same result with the arrow operator? Show how. Suppose the arrow operator would not exist, would we miss something?

3. Give a good use of a remember table.

4. Write an indexed procedure with name **rf**, which returns $\mathbf{rf}[n](x)$, defined by

   $$\mathbf{rf}[0](x) = 1,\ \mathbf{rf}[1](x) = x, \text{ and } \mathbf{rf}[n](x) = (x+1)(\mathbf{rf}[n-1](x) - \mathbf{rf}[n-2](x)), \text{ for } n \geq 2.$$

   The index n is the degree of the polynomial. Make sure the recursion runs efficiently.

5. Explain the difference between diff and D. Illustrate with an example where diff needs to be used instead of D. Give (of course another) example of a case where D needs to be used instead of diff.

6. Consider the following Maple session:

```
> f := 1/x^3:
> int_f := int(f,x=a..b);
                                    2    2
                                   a  - b
                      int_f := - 1/2 -------
                                     2  2
                                    b  a

> subs(a=-2,b=4,int_f);
                                3/32
```

   How do you interpret the result of this calculation?

   Can you suggest a better way to do this calculation?

7. Suppose we want to plot a function with a known singularity, e.g., like the curve $x^4 + x^2y^2 - y^2 = 0$, which has a singular point at the origin. Indicate what you will do to obtain a better plot then what can be done with Maple's implicitplot.

8. Outline how you would in Maple compute all common intersection points of two algebraic curves. For example, consider the circle $x^2 + y^2 = 1$ and the curve $2xy + 2x - 3 = 0$.

9. Consider the Maple session:

```
> p := -4092*x^2*a^2+1734*x^2*a+4158*x^2+310*x*a^2 \
       -6523*x*a+7623*x+3782*a^2-1597*a-3850;
                2  2         2           2          2
  p := -4092 x  a  + 1734 x  a + 4158 x  + 310 x a  - 6523 x a + 7623 x

                  2
          + 3782 a  - 1597 a - 3850

> solve(p,x);
                              2
      5 a - 99 + sqrt(16129 a  + 25386 a + 20601)
  1/2 ----------------------------------------,
                      66 a + 54

                                   2
          5 a - 99 - sqrt(16129 a  + 25386 a + 20601)
       1/2 ----------------------------------------
                           66 a + 54
```

   How do you interpret the solutions? For which values of the parameter `a` are the solution valid. Indicate how to process the output further.

10. Explain the difference between symbolic, automatic, and numerical differentiation.
    For each type of differentiation, give an example of the Maple commands used.

11. What are the differences between a set and a list in Maple?

12. Explain the need for an assume facility in Maple. Illustrate with an example.

13. How would you best solve for x the following expression:

```
              11            8            7            5            3
  -42 sin(x)   + 88 sin(x)  - 76 sin(x)  - 65 sin(x)  + 25 sin(x)  + 28
```

The questions above are just samples of the type of questions you may expect. Also review the homework assignments and quizzes. The experience gained in the project may also help you.

FINAL EXAM is in Taft Hall 0219 on Tuesday 6 May 2003 from 1:00 till 3:00PM.

In case of a scheduling conflict with another final exam, please let me know as soon as possible so we can schedule a makeup.

Observe the university rules concerning incompletes. An incomplete can only be granted if all of the following conditions are satisfied:

1. The student is in good standing and needs only a final exam to complete the course. In particular, this means that no midterms are skipped, attendance to the discussion sessions was documented by quiz scores, and all projects received a satisfactory grade.
2. Some event (for which adequate documentation can be provided) prevented the student from doing a makeup final exam.

Note that these rules are from the university, and that the administration needs to approve incompletes.