CS 20600 Exam 2 Review Problems

Fall, 2011

This exam will be over material from

- Worksheet 4, Sections 4.9 - 4.11,

- Worksheet 5, Sections 5.2 - 5.4.4.

Problem 1: For each of the functions given below, describe what kind function it is, what kind of graph is most appropriate for the function, and give the name of the Maple command that can draw the appropriate graph.

- (a) $(x \rightarrow \ln(x)) + (y \rightarrow \sin(y))$

- (b) $f(x, y) = (\ln(x) + \sin(y), \ln(x) + \sin(y), \ln(x) + \sin(y))$

- (c) $\ln + \sin$

- (d) $x \rightarrow (\ln(x), \sin(x))$

- (e) $\ln(x) + \sin(y)$

- (f) $(x, y) \rightarrow (\ln(x), \sin(y))$

- (g) $u \rightarrow (\ln(u), \sin(u), 0)$

- (h) $x \rightarrow \ln(y) + \sin(x)$

Problem 2: Part (a) A student wanted to graph a circle and used the following command. What result did the student get? What did the student do wrong? What would be the correct command?
```
> plot( [sin, cos], 0..2*Pi );
```

Part (b) A student wanted to graph a circle and used the following command. What result did the student get? What did the student do wrong? What would be the correct command?
```
> plot( x^2+y^2=1, x=-2..2, y=-2..2 );
```

Problem 3: A student entered the following command into Maple and received an error message.
```
> plot( [ t, cos(2*Pi*t), sin(2*Pi*t), t=0..2 ] );
```
The student was probably trying to draw one of two possible kinds of graphs. Explain what the two graphs are that the student might have been trying to draw. Give the correct Maple command for each of the two graphs.

Problem 4: The equation $x^2 - x - 2 = 0$ has only one variable in it, but there is nothing that stops us from graphing this equation as an equation in two or three variables.

- (a) What is the name of the Maple command that can graph this equation as an equation in two variables? What would you expect the graph to look like? Explain why.

- (b) What is the name of the Maple command that can graph this equation as an equation in three variables? What would you expect the graph to look like? Explain why.

Problem 5: Suppose we have defined a Maple function named **f** that represents a real valued function of a real variable. What do each of the following commands draw? Explain how are the graphs related to each other.

```
> plots[implicitplot]( u = f(v), v=-10..10, u=-10..10 );
> plots[implicitplot]( v = f(u), u=-10..10, v=-10..10 );
> plots[implicitplot]( v = f(u), v=-10..10, u=-10..10 );
> plots[implicitplot]( u = f(v), u=-10..10, v=-10..10 );
```

Problem 6: Suppose we have defined a Maple function named **f** that represents a real valued function of a real variable. What do each of the following commands draw? How are the two graphs related to each other?

```
> plot( [ v, f(v), v=-10..10 ] );
> plot( [ f(v), v, v=-10..10 ] );
```

Problem 7: Suppose **f** is a Maple function that represents a two-dimensional vector valued function of a single variable with component function **f1** and **f2**.

```
> f := t -> ( f1(t), f2(t) );
```

What do each of the following commands draw? Explain how are the two graphs related to each other.

```
> plot( [ f(t), t=-5..5 ] );
> plots[spacecurve]( [ t, f(t) ], t=-5..5 );
```

Problem 8: Consider the following function.

$$f(u, v, w) = (w \cos(u), w \sin(v))$$

Show five different ways to define this mathematical function in Maple. All of your definitions should represent the mathematical function using the arrow operator. Three of your definitions should use a single arrow operator and two of your definitions should use two arrow operators.

Problem 9: Let **f**, **g**, and **h** be the following Maple functions.

```
> f := t -> 2*t^2-1:
> g := t -> sin(2*Pi*t):
> h := t -> t^3:
```

Then the following three parametric curves all have the same graph, which is a diagonal line segment from the point (-1,-1) to the point (1,1).

```
> plot( [f(t), f(t), t=-1..1] );
> plot( [g(t), g(t), t=-1..1] );
> plot( [h(t), h(t), t=-1..1] );
```

Explain in what ways these three parametric curves differ from each other. What Maple command (or commands) could you use to demonstrate these differences?

Problem 10: Suppose that:

- the function f is a real valued function of a real variable,

- the function g is a two-dimensional vector valued function of a single variable,

- the function h is a two-dimensional vector valued function of three real variables,

- the function k is real valued function of three real variables,

- the function p is a four-dimensional vector valued function of two real variables,

- the function q is a real valued fuction of two real variables.

Which of the following expressions make sense? If an expression does not make sense, explain why. If it does make sense, describe what kind of function the expression defines.

- (a) $(g @ f)(x)$

- (b) $h(g(t), f(t))$

- (c) $(k @ h)(x, y, z)$

- (d) $p((f @ k)(x, y, z), q(x, y))$

- (e) $k(f(x), g(y), f(z))$

- (f) $p(h(t, t, t))$

Problem 11: Suppose I have defined $f(t)$ as a real valued function of a real variable and then I define the following plot-valued-function.

```
> p := s -> plot( f(t-s)+s, t=s..1+s );
```

The following two commands would create an animation. Describe what the animation would show.

```
> seq( p(i/10), i=0..20 ):
> plots[display]( %, insequence=true );
```

Problem 12: Using proper Maple syntax, write the definition of a plot valued function with two input variables such that the result of the plot valued function is the graph of a line whose slope is determined by the first input to the plot valued function, whose *y*-intercept is determined by the second input, and such that the domain of the graph is the interval $[-|x_0|, |x_0|]$, where x_0 is the *x*-intercept of the line.

Problem 13: Consider the following animation.

- (a) Describe in detail what the first and last frames of the animation would look like.

- (b) What is the role of the parameter **m** in the Maple function **f**?

- (c) What does the animation look like?

```
> f := (t,m) -> piecewise( t<1/2, m*t, t>=1/2, m/2-m*(t-1/2) );
> p := m -> plot( f(x,m), x=0..1 );
> seq( p(n/30), n=0..60 ):
> plots[display]( %, insequence=true, view=[0..1, 0..1] );
```

Problem 14: Suppose that the two real valued functions f(*t*) and g(*t*) are the horizontal and vertical components respectively of a parameterization of the following ploygon in the counter clockwise direction in one unit of time and with (f(0), g(0)) = (0,0).

- (a) Show what the piecewise definition of g(*t*) would look like, using proper Maple syntax.

- (b) Sketch a picture of what the graph of f(*t*) would look like.