Test 3 Information (from Quercus)

Date: Date: Friday, Feb 7
Test Material: 14.5-14.8, 15.1-15.5

Topics Checklist: Section.14

How to use the checklist: First of all, understand every topic intuitively (Geometrical interpretation is usually very useful). Secondly, find an example for each of the topic. You should be able to find those in the tutorial problems, past tests, and suggested problems from the textbook. I did not make a review sheet containing every formulas and graphs as you might expect, because you will get more out of making one yourself. **Notice:** The list may not cover everything you will be tested on.

1. section 14.5 The Chain Rule
   - (14.5.2) If z=f(x(t),y(t)), what is the general formula for computing dz/dt?
   - (14.5.3) If z=f(x(s,t),y(t)), what is the general formulas for computing $\partial z/\partial t$ and $\partial z/\partial s$?
2. section 14.6 Directional Derivatives and the Gradient Vector
   - (14.6.2) What is the definition of the directional derivative of f at (x_0, y_0) in the direction of a unit vector $\mathbf{u} = (a, b)$? What is special about this u?
   - How do you compute the directional derivative by definition? In other words, how do you compute a limit?
   - Given a vector that you want to compute the directional derivative along with, how do you choose the direction vector u to use? Given a vector, how do you find the corresponding unit vector in that direction?
   - What does the directional derivative mean intuitively, different from the partial derivatives?
   - (14.6.1) What are the definitions of partial derivatives f_x and f_y?
   - (14.6.8) What is the definition of the gradient of f, if f is a function of n variables, $x_1, ..., x_n$?
   - How do you compute a partial derivative? For example, $f = sin(xy) + y + z$, what are f_x, f_y, f_z? You will need to use chain rule here.
   - (14.6.9) How do you use the theorem to calculate the directional derivative using the gradient? Under what condition, can you use the theorem?

- (14.4.7/8) How do you know when is the function f differentiable? Is it true that if both partial derivatives of a function exist, then f is differentiable?
- (14.6.15) Suppose f is a differentiable function of two or three variables, what is the maximum value of the directional derivative pointed in which direction?
- (Tutorial 9a) How do you find the value of the fastest rate of change and its direction? What are the procedures?
- (14.6.19) What is the formula for tangent plane to the level surface $F(x, y, z) = k$ at $P(x_0, y_0, z_0)$?
- (14.6.20) What is the formula for the normal line to the surface S with equation F(x,y,z)=k at P?

3. section 14.7 Maximum and Minimum Values

- (14.7.1) What are the definitions of local maximum, local minimum, absolute maximum and absolute minimum?
- (14.7.2) If f has a local max or min at (a,b) and the first partial derivatives of f exist there, what can we say about the partial derivatives $f_x(a, b)$ and $f_y(a, b)$?
- What is a critical point?
- Is it true that, if $f_x(a, b) = 0$ and $f_y(a, b) = 0$, then (a,b) is a maximum or a minimum point?
- What is the second derivative test?
- What is a saddle point?
- (14.7.8) What is the extreme value theorem and what are the conditions of the theorem?
- (14.7.9) What are the procedures of finding the max/min of a continuous function?

4. section 14.8 Lagrange Multipliers

- (14.8.1) What is the method of Lagrange multiplier, and what is the condition of the method?
- (14.8.1) What are the procedures of Lagrange method?
- (Quiz 7)How do you know whether the point **x** that the Lagrange method gives you is a maximum or a minimum?
- How do you set up a model? What are the ingredients of your model?
- What does it mean to say a vector is not zero?
- What happen if you have multiple constraints?

Trust yourself, you know more than you think you do
Never do tomorrow what you can do today
Good luck on your test :) -Nick