

NAME :

HARVARD EXTENSION 2006-2007

THE ENVIRONMENT OF THE EARTH'S SURFACE

This is an open-book take-home examination. It is designed for you to spend about three hours on it. The questions are representative of the kind and level of difficulty I will build into the final examination.

Put the answers to all of your questions in this examination book. Return only the examination book to me.

I CONSTRUCTING YOUR OWN TOPOGRAPHIC MAP (given various constraints [50 points])

On the following page is a blank map of a land area with topographic relief. Note that the map area has a north arrow but no horizontal scale and no stated contour interval. **YOU** have to *fill in the map with realistic contour lines*, and certain other information, to represent in a qualitative way a land area with the features indicated below.

Your map must have at least six contour-line levels within it.

Your map must have at least three well-defined saddle points within it.

Answer all of the questions by use of the blank map. If you want to make sketches of trial maps, use your own blank paper (but don't hand that back).

HINT: Obviously there are zillions of possibilities. Don't just start in to draw any old map. Some initial planning will make life much simpler for you.

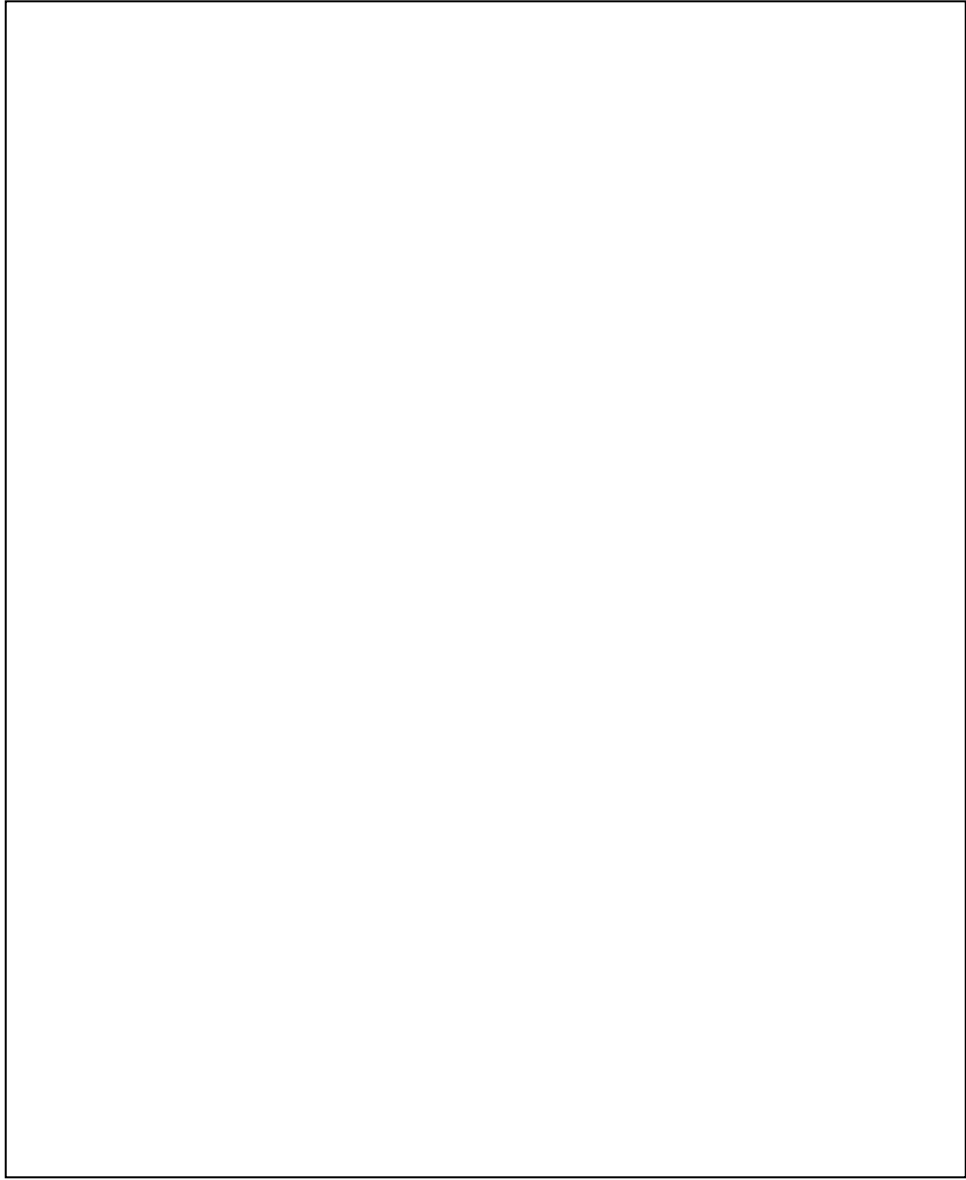
(1) [20 points] You get twenty points just for presenting a self-consistent set of contour lines, with the requisite number of saddle points, that represent the topography you are assuming.

Four streams flow out from the map area across the boundaries of the map. These streams flow in recognizable and well-defined valleys, and each has a number of tributary streams that also flow in recognizable and well-defined valleys. Be sure to adjust the contour lines to reflect the stream valleys!

(2) [20 points] *Draw the courses of all of the streams on your map by solid curves.*

(3) [10 points] *Draw the divides between the drainage areas of the major streams (i.e., the four that flow out of your map area) by dashed curves.*

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II GROUNDWATER [50 points]

You are made responsible for a particular cubic meter of regolith with its upper surface located about two meters below the ground surface. *List, and comment briefly upon, the factors that determine the rate of groundwater flow through the given cubic meter of regolith.*

Answer this question in the space provided below.

III RIVER SYSTEMS [50 points]

Part A [25 points]

Imagine that humankind were to do something catastrophic in the near future so as to cause the melting of most or all of the ice in the Greenland Ice Sheet, thereby raising sea level around the world by something like five meters. In the following blank pages, describe in as much detail as you can (both in words and, where you think them appropriate, with diagrams), *what would happen to the major river systems of the world*, in terms of the following aspects or features:

- discharge
- longitudinal profile
- sediment load
- channel pattern
- valley morphology
- nature of valley-fill deposits

In each case, indicate something about the firmness of your prediction: it could range from almost certain to highly speculative.

Part B [25 points]

The climate suddenly cools, worldwide. We enter upon a new ice age. Continental glaciers build up rapidly (in reality, they would not build up rapidly, but for sake of discussion ...). Sea level is lowered by about five meters.

What would happen to the major river systems of the world, in terms of the same aspects or features as in Part A? Answer this question in the same way as in Part A, on the following blank pages.