Watershed Delineation from a Digital Elevation Model

Following is a grid of elevations in a 30 m digital elevation model.

21	21	21	21	21	21	21
21	24	24	24	24	24	21
21	18	18.4	19.2	15.9	19.5	19.5
21	24	18	18.3	16.2	18.3	18
15	21	19.8	18.6	16.2	16.8	16.5
15	19.5	21	21	21	15	14.7

1. On the above grid, determine **which grid cells are pits** and indicate the elevation to which they need to be raised to **fill** them.

2. For the inner block of 4 x 5 grid cells indicated by the box determine the **D8 flow direction** and indicate this using an arrow on the diagram below. Use pit filled elevation values.
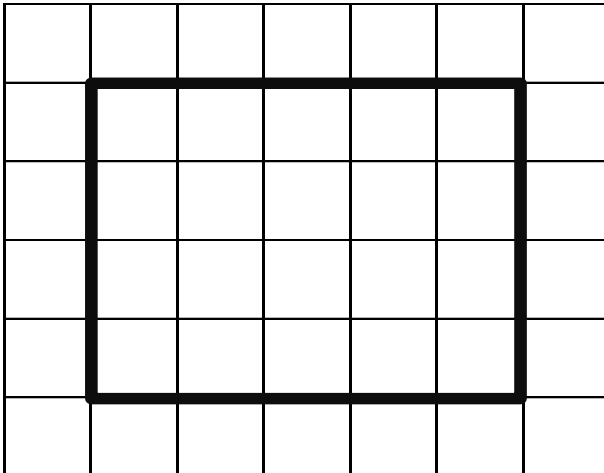

Note. Flow directions are not evaluated along the edges because they may depend on data outside the domain. Indicate any grid cells where there is ambiguity and flow direction needs to be arbitrarily chosen. Comment on how it may be good for the computer to evaluate flow direction in these cases.

3. Calculate the **D8 slope** for the two cells indicated below. Use pit filled elevation values.

| 21	21	21	21	21	21	21
21	24	24	24	24	24	21
21	18	18.4	19.2	15.9	19.5	19.5
21	24	18	18.3	16.2	18.3	18
15	21	19.8	18.6	16.2	16.8	16.5
15	19.5	21	21	21	15	14.7

4. Calculate the **flow accumulation** for all grid cells in the inner 4 x 5 block indicated by the bold box. Write your answers (reported in terms of the number of grid cells flowing into each grid cell) in the diagram below. On this diagram also indicate the watershed draining to the grid cell labeled A by drawing a line around it.

			A			

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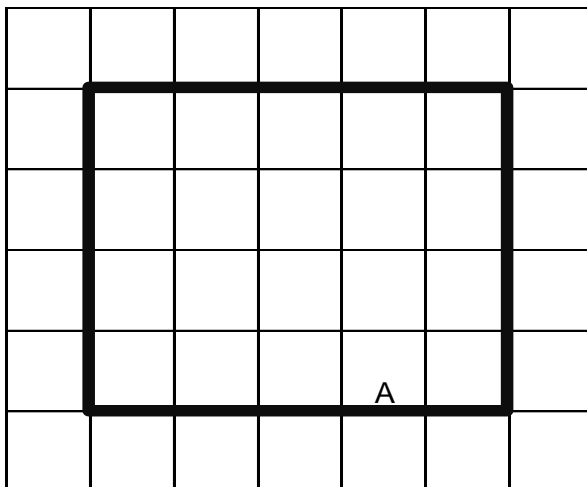
5. Determine a stream network using a **flow accumulation** threshold of 3 grid cells and indicate the grid cells that comprise the stream network. Identify each segment of your stream network using a unique number in the diagram below. You should only fill in stream segment numbers for grid cells on the stream network.
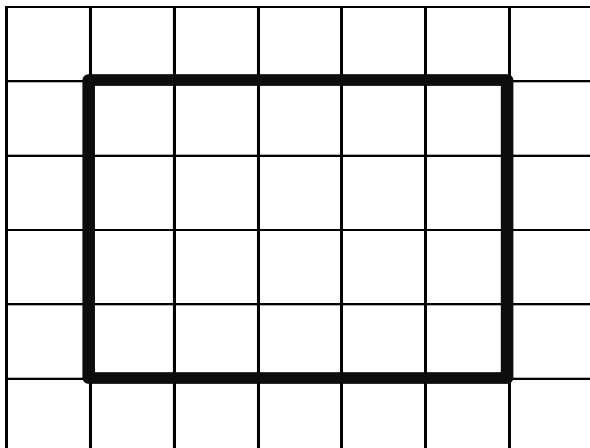
6. Determine the grid cells belonging to the catchment draining to each stream segment and fill in numbers in the diagram below indicating the catchment grid.
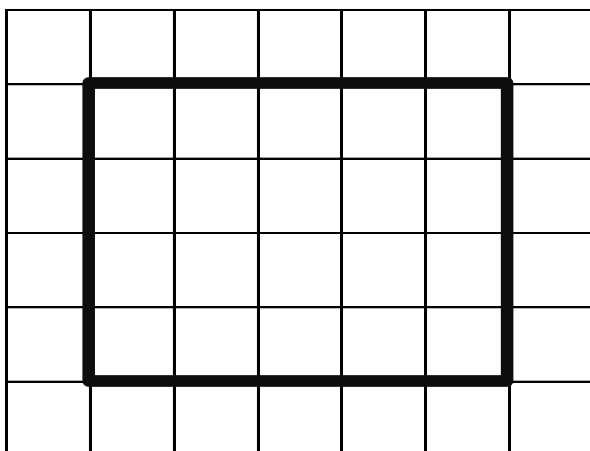
7. Prepare a table giving the length of each stream segment and the drainage area of the corresponding catchment. Also indicate the total area and total length of the stream network draining to grid cell A. Report the drainage density for this stream network.