Selftest for the program Master of Computer Science at KU Leuven

Write all answers in the answer boxes. When an explanation is asked, be as specific as possible.

Question 1

- A given implementation of **bubble-sort** takes on average 1 second to sort an array of 1000 elements. How many seconds do you expect sorting an array of 8000 elements will take?

- A given implementation of **quicksort** takes on average 0.1 seconds to sort an array of 1000 elements. How many seconds do you expect sorting an array of 8000 elements will take?

Question 2

What is the shortest path between A and Z in the graph below? (The length of a path is the sum of the numbers along the edges on the path.) Explain briefly how you have found this solution: what algorithm or solution strategy did you use? Does it work on any graph?

Path (e.g., A-B-E-Z) : | A -   - Z |

Explanation :
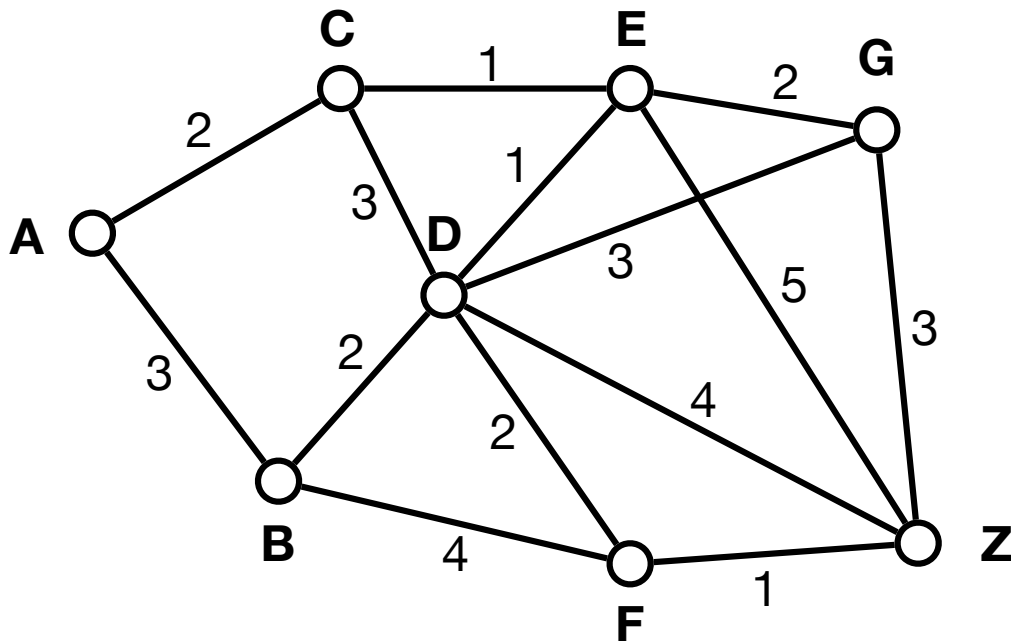
Question 3

Below is a function f. We are interested in how changes in the values of the input variables x, y or parameters a, b, c affect f. To that aim, we write f as a function of both its input variables and its parameters, using the notation $f(x, y; a, b, c)$. The "gradient of f towards $\mathbf{v}$", denoted as $\nabla_{\mathbf{v}} f$, is the vector of all partial derivatives of f to the variables/parameters listed in $\mathbf{v}$. Fill in the boxes.

- $f(x, y; a, b, c) = a \exp(2x) + by^2 + cxy$

- $\nabla_{x,y} f(x, y; a, b, c) = $

- $\nabla_{a,b,c} f(x, y; a, b, c) = $

- If δ, ε are very small real numbers, what is $f(1,2; 3,4+\delta,5+\varepsilon) - f(1,2; 3,4,5)$ approximately? Explain how you obtained the answer.

Answer:

Explanation: