

Example questions

on real exam you will have choice of 4 answers

and one open question (here question no 11)

1. A digital image can be defined as a matrix consisted of pixels. In case of an image in a grey scale (monochromatic) it is a 2D matrix. A coloured image is written in the form of a 3D matrix in such a way that every colour is represented by one matrix: red (R), green (G), blue (B). The proper combination of RGB channels results in a real-colours image. If a monochromatic airborne image of the area 2km x 2km takes 12 MB on a disc, an RGB image of the area of 16 km² will take about:

2. One of the ways to define resolution of an image is expressing the size of a pixel in the field unit, e.g. 10m/pix means that one pixel reflexes a square of 10mx10m in the field. An image 15x15 pix of resolution 1m/pix contains 225 pixels, how many pixels would have an image presenting the same area of resolution 0.5m/pix?

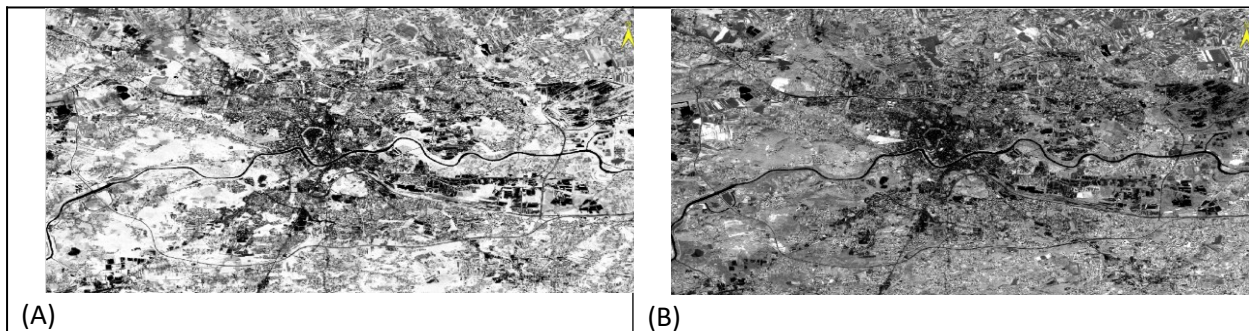
3. Examining the positional accuracy of 15 points controlled on the orthophotomap the following deviations, i.e., differences between real position and the position based on the orthophotomap (in metres) were obtained: 2.10, 2.00, 1.30, 0.96, 2.20, 1.30, 2.89, 0.56, 1.30, 1.70, 1.30, 2.00, 1.30, 2.00, 2.02. Mean point position error estimated as median of the above mentioned measurements is:

4. The images below show images of Normalized Difference Vegetation Index (NDVI), calculated using two satellite image channels: red (RED) and infrared (NIR), according to the following formula:

$$\frac{(NIR-RED)}{(NIR+RED)}$$

The values of the index take values in the range $\langle -1, 1 \rangle$. The lowest values below 0 represent water-type objects, while the maximum values of the index close to 1 represent vegetation objects with the highest chlorophyll levels.

For each image, assign the seasons (summer, winter) for which the index was calculated.



-1 1

5. Give the values of the Euclidean distance around the object (highlighted in grey) for the cells knowing that the field size of a cell (pixel) is 20m and the distances are calculated from the centre of the pixels/cells:

6. Functions allow the calculation of the value $f(x, y, \dots)$ base on one or more arguments x, y, \dots . Having a function with one argument: $f(x) = x^2 + 7 \cdot x + 2$. Give the value of the function for $x = 3$

7. Objects in the image can be subdued to the following transformations: rotation, translocation, scaling. Applying these transformations, define how many squares are there on the plane Oxy, if point A (-1,-1) is one of the apexes and the symmetry axis is at least one of the axes of the system of coordinates?

8. In spatial analyses, one method is to use raster maps that take in areas that are acceptable for investment (=1) and rejected (=0). Various combinations of these factors are then taken into account. Below is an example of this approach, based on three raster maps.

Select the result of the logical operation (Map_1 AND Map_2) OR Map_3

(0-colour white, 1-colour grey)

map1

map2

map3

9. You have a database of traffic information in a city. The data includes information about time, location, speed, and direction of movement for each vehicle. Your task is to identify areas of the city with the heaviest traffic and determine the most common direction of travel for cars.

What steps would you take to solve this task?

10. Below is a diagram of a relational database schema containing information about satellite-based meteorological observations. Based on this schema, determine which of the given hypotheses is correct.

Table: satellites

ID	Name
1	NOAA-18
2	METOP-A
3	GOES-16
4	Himawari-8

Table: Measurements

ID	Satellite_ID	Date	Temperature (°C)	Humidity (%)
1	1	2023-05-01	23	70
2	2	2023-05-01	18	65
3	3	2023-05-01	25	75
4	4	2023-05-01	20	60
5	1	2023-05-02	20	72
6	2	2023-05-02	16	68
7	3	2023-05-02	24	78
8	4	2023-05-02	19	62

Hypotheses:

1. The satellite named "GOES-16" recorded the highest temperature on May 2, 2023.
2. The satellite named "METOP-A" recorded the lowest humidity on May 1, 2023.
3. The difference between the highest and lowest temperatures recorded on May 2, 2023, is 7 degrees.
4. The average humidity recorded by satellite with ID 2 on both days is 67%.

11. In your own words describe the algorithm (way), which would allow you to practically calculate the square root of a given number.

12. On a walkway moving left, in 3 subsequent photos taken from the same point and in the same direction you can see a man. Estimate in which direction and how (resting, uniform motion, accelerated motion) this man is moving, in the relation to the outside world, not the moving walkway.



13. You have three pictures of Lena (I, II, III). Which two images have equal contrast?

I)



II)



III)



14. You have two pictures of Lena (I, II). What is the correlation (understood as the similarity between the sets of brightnesses of the corresponding image pixels, expressed in r or R^2) between images 'I' and 'II':

I)



II)



15. A set of scattered points with X, Y, Z coordinates can be connected together to obtain a triangular grid. Such a process is called triangulation. Triangulation can also be applied on polygons to obtain a better description of the model surface. Thus, if we perform triangulation on a pentagon, a mesh composed of: