Q1

Table 1 shows temperatures observed at the places A-D. The temperature is unknown for the location P, located 110 units East and 70 units North in this coordinate system.

Location	Coordinates	Temperature
A	(20, 10)	10
B	(120, 10)	5
C	(120, 110)	-10
D	(20, 110)	2

a) What is the temperature at P by nearest neighborhood interpolation?
b) What is the temperature at P by bilinear interpolation (answer in two decimal place, such as 1.23)?

Q2

Find out the area of a polygon p1,p2,p3,p4.

p1	5	1
p2	7	2
p3	10	9
p4	2	6

Q3

The 4-intersection matrix describes the relation between two simple regions A and B by the qualitative properties of four intersection sets between the interiors(i) and boundaries(b) of A and B:

$$\begin{bmatrix} A^i \cap B^i & A^i \cap B^b \\ A^b \cap B^i & A^b \cap B^b \end{bmatrix}$$

Assume that ⊗ denotes a non-empty intersection set, and ∅ denotes an empty intersection set. Which is the 4-intersection matrix of “Meets”

a. $\begin{bmatrix} \emptyset & \emptyset \\ \emptyset & \otimes \end{bmatrix}$ b. $\begin{bmatrix} \otimes & \otimes \\ \emptyset & \emptyset \end{bmatrix}$ c. $\begin{bmatrix} \otimes & \otimes \\ \emptyset & \otimes \end{bmatrix}$

d. $\begin{bmatrix} \otimes & \emptyset \\ \otimes & \emptyset \end{bmatrix}$

Q4

Your company plans to develop a bridge of an estimated cost of 2.4 million dollars and estimated construction time of one year from project start. After the year, the bridge will be opened for lightweight vehicles and small trucks. The lightweight vehicles will pay a toll of $5, and the small trucks will pay a toll of $10. If 15,000 lightweight vehicles and 2,500 trucks pass the bridge in every month, in which year will the company reach break-even?

Q5

Which of the following concepts form a partition:

Group of answer choices:
the states of a nation
suburbs in a city
bird habitats
a tram network

Q6

The grid shown below represents a digital elevation model (DEM), with terrain elevation. The grid size of the DEM is 100m. The origin of the grid coordinates is in the lower left corner, and coordinates are counts of columns (1st axis) and of rows (2nd axis).

70	65	76	76
65	70	64	72
70	64	70	68

For any focal operation with a 3x3 operator, what is the size of the resulting grid? (Answer pattern column number followed by row number separated by comma, such as x,y). ( )

Determine the value at (2,2) after smoothing using the 4-neighborhood.

Apply the differential operators [0,0,0 / -1,0,1 / 0,0,0] and [0,-1,0 / 0,0,0 / 0,1,0] at (2,2) and determine the value at (2,2) after filtering in x direction and filtering in y direction .

What is the gradient of the DEM at (2,2) (Answer in two decimal place, such as 1.23).

What is the aspect of the DEM at (2,2).

Q7

Two line segments are represented by l1 (p1, p2) and l2 (p3, p4). The coordinates of p1, p2, p3, p4 are given in the following table.

p1	10	20
p2	60	80
p3	30	10
p4	10	40

Determine if l1 and l2 intersect or not. (Answer Yes or No)

What is the determinant value of p2, p3 and p4.

What is the determinant value of p4, p1 and p2.

Q8

Which phenomenon does always form planar graphs:

Group of answer choices
the complete graph of four nodes, K4
the grid network of a digital elevation model
a tram network
the complete graph of six nodes, K6

Q9

What are typical elements of data quality from a provider's perspective?

Group of answer choices
metadata
price
completeness
scale

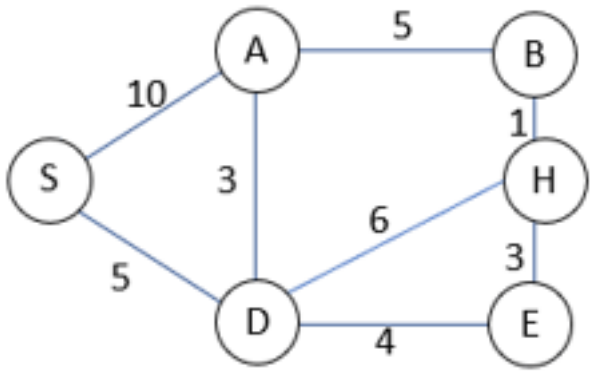
Q10

Which of the following properties is a property of topological transformations:

Group of answer choices
preserving colour
None of the above
preserving directions
preserving size

Q11

The following figure shows a travel network, with the costs for traveling between the nodes.



What is the shortest path from Node S to Node H? (Specify as a sequence of nodes without comma or blanks, such as in “XYZ”).

What is the cost of this shortest path?

What is the minimum spanning tree of paths from Node S? (Specify as list of branches, all starting in S, separated by a comma but no blank, such as in “SUVW,SXYZ”)

What is the degree centrality of Node D?

For the sub-network SABHD alone (which forms a cycle), what is the betweenness centrality of Node A?

Q12

Question 12 5 pts

Use the formula to compute a Delaunay triangulation. Apply the formula for the given set of four points A, B, C, and D. Choose the initial triangle of A, B, C to start with.

In order to add D to the triangulation, compute first the point-in-triangle test: D is inside the triangle if it is ____ of AB, ____ of CB, and ____ of CA. (Answer pattern Left or Right separated by a comma but no blank, such as in “Right,Left,Left")

In order to determine the above locations have to resolve a determinant. What is your result, as a numerical value, for the location of D with respect to AC?

Since the point-in-triangle fails, you have to test whether D is at least inside the circumcircle of ABC. What is the centre of the circumcircle of ABC? (Answer pattern x,y)

What is the radius of the circumcircle of ABC? (Answer in two decimal place)

Is D inside the circumcircle of ABC? (Answer pattern Yes or No)

Q13

What are the project management approaches you learned about?

Group of answer choices
None of the above
Spiral model
Nested model
Agile model

Q13

What are the project management approaches you learned about?

Group of answer choices
None of the above
Spiral model
Nested model
Agile model

Q14

The Universal Transversal Mercator projection is:

- [ ] a conical projection
- [ ] a cylindrical projection
- [ ] an azimuthal projection
- [ ] a spherical projection

Question 15 — 2 pts

Is a Delauney Triangulation any of the following

- ○ a general 3-complex
- ○ a simplicial 2-complex
- ○ a general 2-complex
- ○ a simplicial 3-complex

Question 16 — 3 pts

We want to measure the position of a point Pn(xn, yn) with respect to a reference position P0 (0, 0). The coordinates of a known point P1 are (0, 10). The angle between P1 and Pn is 30 degree. The distance of Pn from the reference point P0 is 20. Find out the coordinates of Pn. (Answer pattern x,y in two decimal place)

Question 17 — 4 pts

Person A and Person B, calling each other from their homes, try to arrange a meeting at a coffee shop. They have a choice between Shop 1 and Shop 2. Both are ready to leave now. The problem constraints are:

Distance [km]	Shop 1	Shop 2
A's home	1	2
B's home	2	1

	Walking speed	Has to be back at
A	4	2
B	5	1

Which shop should they choose to have more face-to-face meeting time with each other? (Answer 1 or 2) _____

How much time will they have face-to-face? (Answer in minutes) _____

Question 18 — 2 pts

Stevens (1946) proposed that measurements can be classified into different types of scales. Which elements of the following list did he propose:

- [ ] geographic
- [ ] urban
- [ ] nominal
- [ ] continuous

Question 19

2 pts

Which of the following terms characterize concepts of graph theory:

- [ ] rides
- [ ] hikes
- [ ] drives
- [ ] walks

Question 20

2 pts

Which of the following are operators of cartographic generalization:

- [ ] enhancement
- [ ] enrichment
- [ ] mapping
- [ ] displacement

Question 21

2 pts

A sink in a DEM is a location

- ( ) Where the aspects of 2 neighbouring nodes are pointing to
- ( ) Where the aspects of 4 neighbouring nodes are pointing to
- ( ) Where the aspects of 3 neighbouring nodes are pointing to