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Question 27

You have acquired an 8 bit single band image and calculate the histogram. It shows normal distribution centered at 127 but covering half the range [63,191]. Select the 2 correct statements from the following list. An incorrect selected answer, cancels a correct selected answer.

- ☐ The brightness of input value 127 after a 2 standard deviation stretch and a minimum maximum stretch is not the same
- ☐ When you select a standard deviation stretch using 2 standard deviations you will create an image which has black pixels but no white pixels
- ☐ When you select a standard deviation stretch using 2 standard deviations you will create an image which has equal numbers of black and white pixels
- ☒ When you select the standard deviation stretch using 2 standard deviations you will not be sure you have efficient contrast enhancement
- ☐

Correct answer

You Answered

Correct!

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Band	Wavelength (μm)
Band 1 (VIS)	0.45 to 0.515
Band 2 (VIS)	0.525 to 0.605
Band 3 (VIS)	0.63 to 0.69
Band 4 (NIR)	0.75 to 0.9
Band 5 (SWIR)	1.55 to 1.75
Band 6 (TIR)	10.4 to 12.5
Band 7 (MWIR)	2.08 to 2.35
Band PAN (VIS)	0.52 to 0.9

Correct answer

☒ Light magenta

☐ Gray-Brown

☐ White

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0 / 0.4 pts

Question 28

What is the colour of Dry bare soil (Gray-brown) in a displayed Landsat ETM+ image, when applying the band combination RGB = 2, 4, 5?

For each band the DN values were converted to reflectance values. The Landsat ETM+ wavelength bands are shown in the table below. Typical reflectance curves of the objects available in the image are shown in the figure.

The graph shows three reflectance curves. The x-axis represents Wavelength (µm) from 0.4 to 2.6. The y-axis represents Reflectance (%) from 0 to 60. The legend indicates: Dry bare soil (Gray-brown) is a dotted line, Vegetation (Green) is a solid line, and Water (clear) is a dashed line. The vegetation curve shows a sharp dip around 1.4 µm and a peak around 1.6 µm. The water curve is very low across all wavelengths. The dry bare soil curve is relatively flat, with a slight increase around 1.6 µm.

Band	Wavelength (µm)
Band 1 (VIS)	0.45 to 0.515

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0.38 / 0.5 pts

Question 25

Look at the three maps below. They are all based on the same data but visualized in a completely different way. The data depicted is the total length of cycle tracks in kilometres per province of the Netherlands. Use your knowledge of cartographic grammar and select the correct answers from the drop-down lists.

Cycletracks in the Netherlands
Total length of tracks in km per Province

A

Cycletracks in the Netherlands
Total length of tracks in km per Province

B

Cycletracks in the Netherlands
Total length of tracks in km per Province

C

The nature of the data used in the maps is [Select]. The visual variable chosen for the maps should create the [Select] perception for that measurement scale.

The nature of the data used in the maps is [Select]

the visual variable

chosen for the maps should create the [Select] perception for that measurement scale.

Map A: For showing the data the visual variable [Select] is used, this visual variable was a [Select] choice.

Map B: For showing the data the visual variable [Select] is used, this visual variable was a [Select] choice.

Map C: For showing the data the visual variable [Select] is used, this visual variable was a [Select] choice.

Answer 1:

Correct!

Quantitative Ratio Absolute

Answer 2:

Correct!

Quantitative

Answer 3:

Question 26

0.3 / 0.3 pts

In the Cartographic Grammar theory, we mentioned that a key concept in this theory is the PERCEPTION that users get by looking at variations in graphical symbols. Looking at symbols we either get an associative perception, or a perception of order, or a quantitative perception. We also stated that "*this perception is pre-attentive*". Of the multiple choices below, choose the one that most accurately describes what the statement in quotes means:

Select the one correct answer from the following list.

Correct!

- ☐ This perception is dependent on the attention the creator of the graphic pays to it.
- ☒ This perception is automatic and involuntary, it takes place in our minds even before we realize it.
- ☐ This perception is automatic and involuntary, it takes place in our minds even before we have seen the visual variables.
- ☐ This perception is dependent on the attention the user pays to it.

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Quantitative

Answer 3:

Correct answer Texture

You Answered Form

Answer 4:

Correct! Bad

Answer 5:

Correct answer Value

You Answered Colour

Answer 6:

Correct! Bad

Answer 7:

Correct! Size

Answer 8:

Correct! Good

0.3 / 0.5 pts

Question 22

Indicate whether the following statements are true or false.

Relationships between relations in a relational data model are created by using primary and foreign keys [Select]

The rows in a table follow a certain order and this order is crucial for the database to function properly [Select]

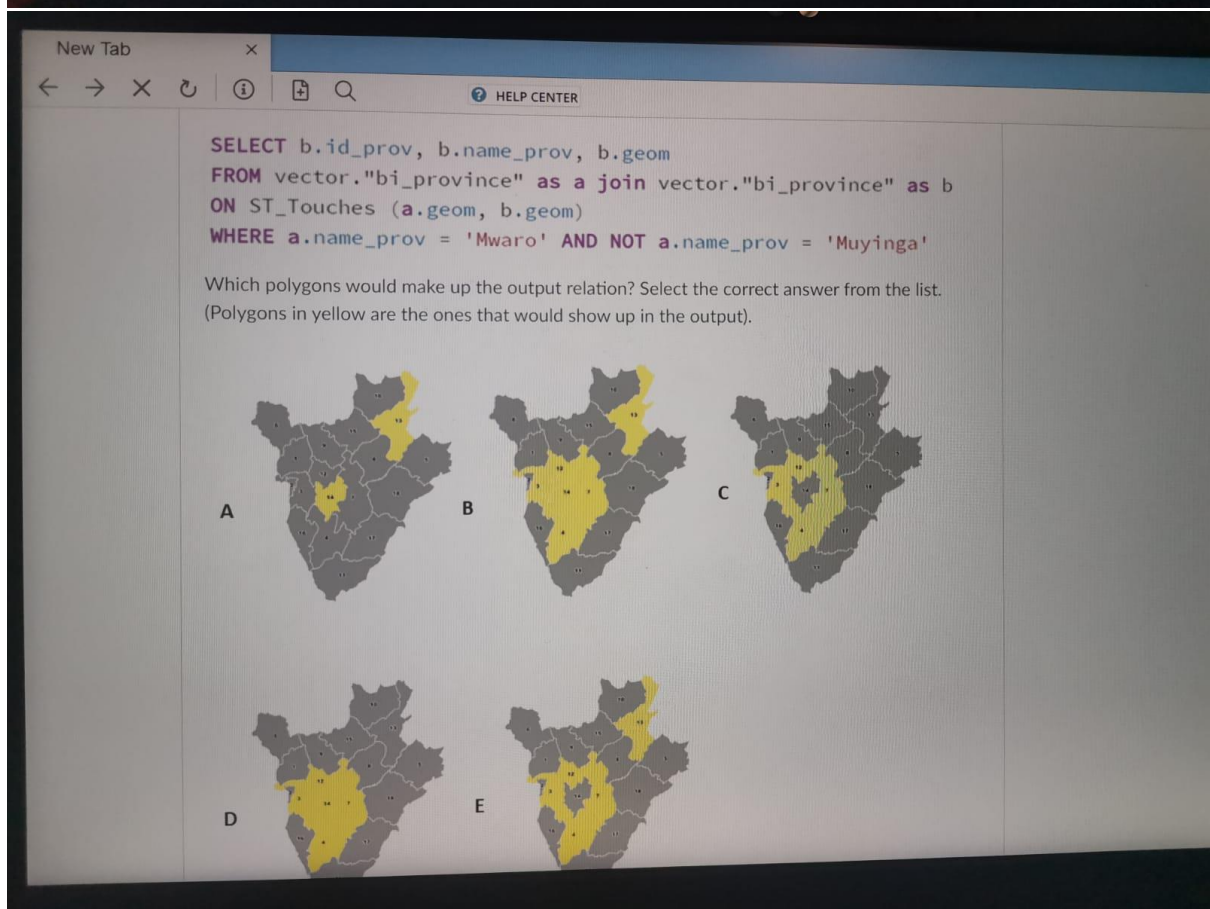
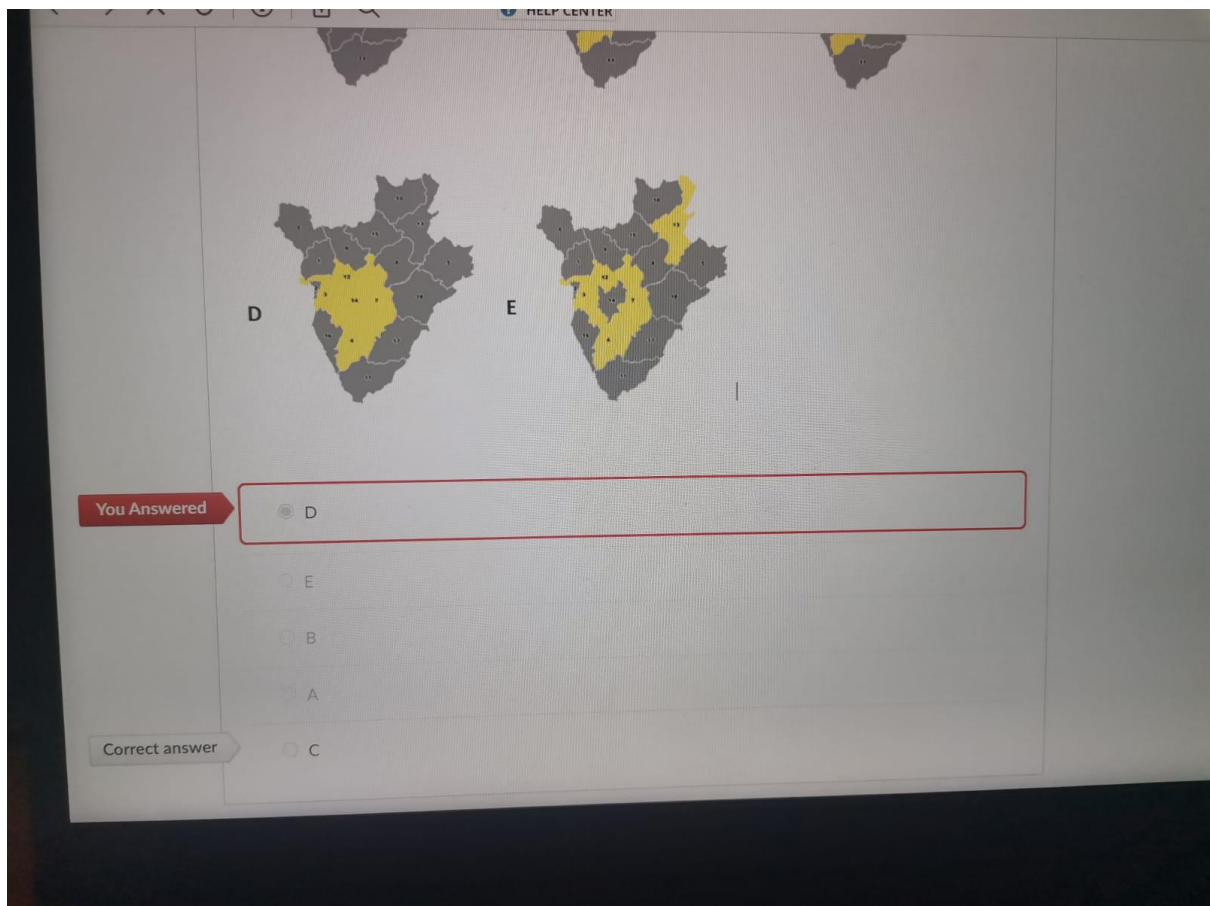
Primary and foreign keys must always be unique [Select]

If you want to add a column to an existing relation in your database, you need to use a DDL (Data Definition Language) command [Select]

In the data modelling step of a database design process, we identify entities to be modelled. They will be represented as tuples in tables where the columns describe its relevant properties. [Select]

Answer 1:

Correct! True



Question 24

0 / 0.45 pts

Below you see a relation that represents administrative units in Burundi, and a visualization of its geometry. The numbers (labels) inside the district polygons correspond to the numbers in the field "gid".

gid [PK] integer	id_prov character varying (80)	name_prov character varying (80)	geom geometry
1	BDI001	Bubanza	0106000020E61000
2	BDI017	Bujumbura Mairie	0106000020E61000
3	BDI002	Bujumbura Rural	0106000020E61000
4	BDI003	Bururi	0106000020E61000
5	BDI004	Cankuzo	0106000020E61000
6	BDI005	Cibitoke	0106000020E61000
7	BDI006	Gitega	0106000020E61000
8	BDI007	Karuzi	0106000020E61000
9	BDI008	Kayanza	0106000020E61000
10	BDI009	Kirundo	0106000020E61000
11	BDI010	Makamba	0106000020E61000
12	BDI011	Muramvya	0106000020E61000
13	BDI012	Muyinga	0106000020E61000
14	BDI013	Mwaro	0106000020E61000
15	BDI014	Ngozi	0106000020E61000
16	BDI018	Rumonge	0106000020E61000
17	BDI015	Rutana	0106000020E61000
18	BDI016	Ruyigi	0106000020E61000



You perform the following query:

```
SELECT b.id_prov, b.name_prov, b.geom
FROM vector."bi_province" as a join vector."bi_province" as b
ON ST_Touches (a.geom, b.geom)
```

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You Answered

SELECT

Selected tuple

DML (Data Manipulation Language) command

Correct!

A."ID"=C."ID"

Join condition

Correct!

A."id", A."Name"

Projected attribute

Correct!

AND

Logical connective

Correct!

"Airports", "Counties", "Arrivals"

Input relation

Other Incorrect Match Options:

- DDL (Data Definition Language) command
- Atomic formula
- Selected tuple
- Output relation
- Relation aliasing

[Select]

Answer 1:

Correct! True

Answer 2:

Correct! False

Answer 3:

You Answered True

Correct answer False

Answer 4:

You Answered False

Correct answer True

Answer 5:

Correct! True

Question 21

The database *cultural_facilities* has the following relations:

Musea					
MuseumID	TypeID	Name	CityID	Location	Geom
[PK] varchar(10)	varchar(10)	varchar(50)	varchar(10)	varchar(10)	geometry
MPL024	M13	Collection Lévi-Strauss	MPL	Centre	Point

Cities				
CityID	Name	RegID	Pop_2020	Shape
[PK] varchar(10)	varchar(50)	varchar(10)	integer	geometry
MPL	Montpellier	FR-OCC	299096	Point

Musea_type		
TypeID	Type	Subject
[PK] varchar(10)	varchar(50)	varchar(50)
M13	University musea	Human sciences

Regions			
RegID	Name	Pop_2023	Geom
[PK] varchar(10)	varchar(50)	integer	geometry
FR-OCC	Occitanie	5973969	Polygon

Match each group of items with the correct fitting concept.

Correct! Musea; Cities

Correct! Geom; Shape

Relation

Spatial attributes

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0.38 / 0.45 pts

Question 23

Given the following Query:

```
SELECT A."Name", B."Name" as region
FROM "Airports" as A, "Counties" as B, "Arrivals" as C
WHERE A."ID"=C."ID" AND B."Code"=C."Code" AND C."Visitors" > 500
```

Match each group item(s) with the correct fitting concept.

Correct!	as region	Attribute aliasing
You Answered	SELECT	Selected tuple
		DML (Data Manipulation Language) command
Correct!	A."ID"=C."ID"	Join condition
Correct!	A."ID", A."Name"	Projected attribute

New Tab x

HELP CENTER

Match each group of items with the correct fitting concept.

Correct!	Musea; Cities	Relation
Correct!	Geom; Shape	Spatial attributes
Correct!	varchar; geometry	Attribute domain
Correct!	Cities.RegID; Musea.TypeID	Foreign key
Correct!	Musea.Location; Region.name	Non-spatial attributes
Correct!	M13; University musea; Human sciences	Tuple

Other Incorrect Match Options:

- Relation instance
- Relations schema
- Relation domain
- Database schema

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0 / 0.4 pts

Question 19

You want to do an atmospheric correction of one image observed by the MSI instrument on Sentinel-2. The image is of a forest and shows no other landcover than dense trees. In the middle of the forest is a tower on which an instrument is mounted with which you detect radiation in the visible and near-infrared range coming from the canopy. You have no access to data on the atmospheric composition on the day of the satellite image. Which type of atmospheric correction is the most accurate? Select the one correct answer from the following list.

Correct answer

- ☐ reflective-invariant pixel
- ☐ absolute radiometric
- ☐ dark object subtraction
- ☐ None
- ☒ radiative transfer modelling

You Answered

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0.2 / 0.2 pts

Question 20

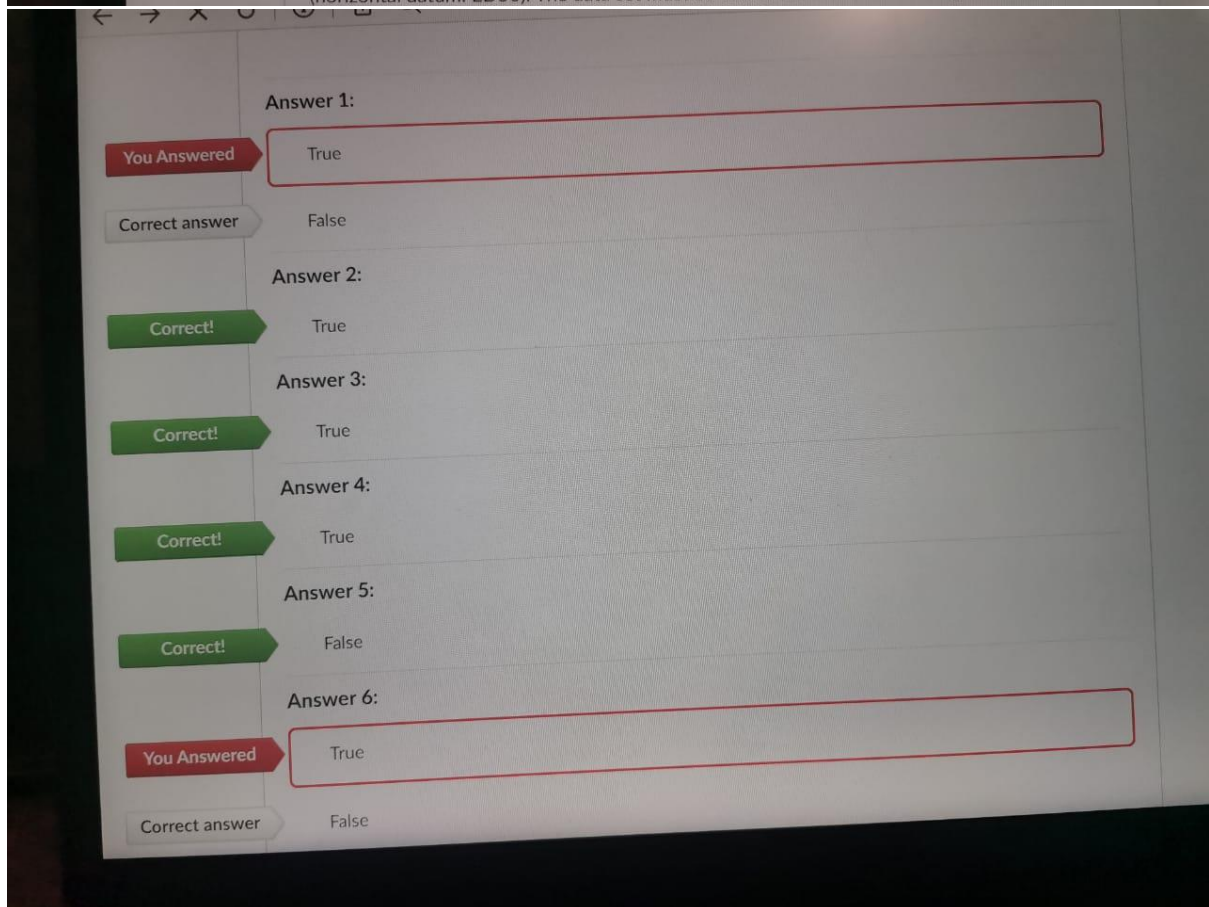
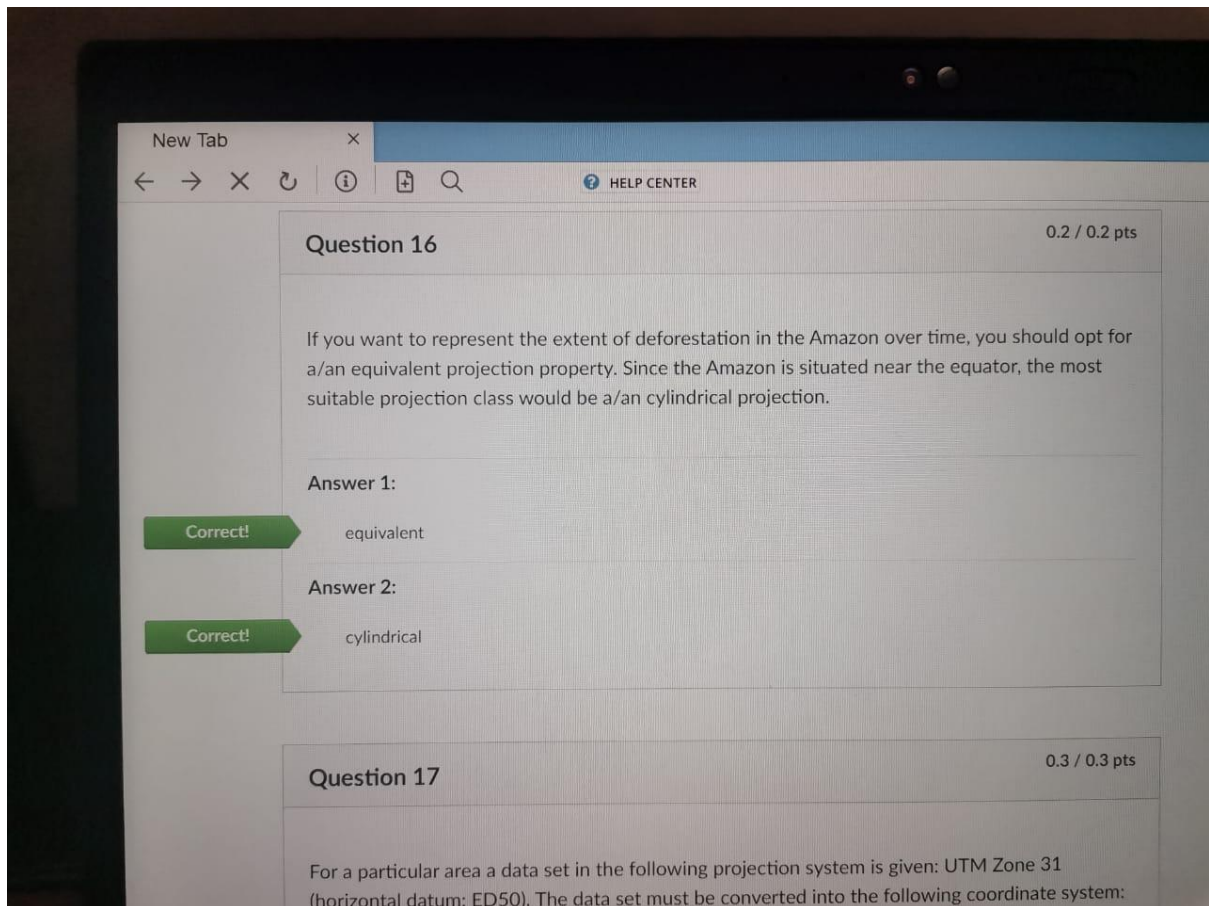
Which gases together absorb nearly all of the radiation emitted by Earth within the atmospheric window region?

Correct!

- ☐ CO₂ and O₂
- ☐ H₂O and CO₂
- ☐ O₂ and H₂O
- ☒ None
- ☐ H₂O and O₃

0.4 / 0.4 pts

Question 21



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0.2 / 0.3 pts

Question 18

Indicate for each of the statements below if they are true or false.

The dark object subtraction method assumes a linear relationship between radiances of consecutive images. [Select]

Application of the dark object subtraction method causes a shift of the histogram of brightness values. True

The dark object subtraction needs to be performed on each channel separately. [Select]

The reflective-invariant pixel method is a computationally cheap method that can be applied to a time series of images. [Select]

The reflective-invariant pixel method assumes a linear relationship between reflectances from different wavelength bands. [Select]

A satellite observation of clouds can be used as a reflective-invariant pixel due to its high reflectivity, which is invariant with respect to wavelength. [Select]

Answer 1:

You Answered True

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0.3 / 0.3 pts

Question 17

For a particular area a data set in the following projection system is given: UTM Zone 31 (horizontal datum: ED50). The data set must be converted into the following coordinate system: UTM Zone 32 (horizontal datum: WGS84). The coordinate transformations in the correct sequence are:

Select the ONE correct answer from the following list.

- ☐ An inverse map projection, followed by a forward map projection.
- ☐ A forward map projection, followed by a datum transformation and an inverse map projection.
- ☒ An inverse map projection, followed by a datum transformation and a forward map projection.
- ☐ A forward map projection, followed by an inverse map projection.
- ☐ A forward map projection, followed by a datum transformation.

Correct!

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This laser dot located at the Onze Lieve Vrouwetoren (church tower) in Amersfoort, is the central point of the Dutch map projection of the National Triangle Survey (with coordinates +155 000 m +463 000 m) RD datum. This is a curiosity. Now, assume that you have a raster image georeferenced in this coordinate system and you would like to be able to read UTM coordinates without changing the pixels and their values. Select the 2 correct possibilities. A wrong answer cancels a correct selected answer.

☐ Directly change the coordinate system (EPSG) of the image to the one corresponding to UTM.

Correct! ☒ Transform the GCP's coordinates used for the georeferencing from RD to UTM keeping their row and columns.

Correct! ☒ Delete the georeference of the image and do a new procedure with GCP's in UTM.

☐ Do a geocoding (warping) of the image changing the coordinate system to UTM.

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Define which statements are correct in the following list. Select the (3) correct answers. An incorrect answer cancels a correct answer.

☐ Semi-major axis (a) and semi-minor axis (b) together, can be used to define an ellipsoid. The semi-major axis is directed towards the pole, the semi-minor axis is located along the equator.

Correct! ☒ The definition of a geodetic datum includes (among other things) the reference to a particular ellipsoid.

☐ The geoid undulation is the deviation between two ellipsoids.

Correct! ☒ One location on the Earth can have different geographic coordinates. The differences in coordinates can be up to several hundreds of meters.

Correct! ☒ The longitude of a point is the angle between the meridian ellipse that passes through Greenwich and the meridian ellipse containing the point in question. Lines of equal longitude are called meridians.

☐ The geoid is not a smooth, uniform surface due to the movements of tectonic plates.



The original pixel size is 10 m. The final geocoded pixel is shown in red (only 1 is shown).

What is the value of the red pixel after geocoding if you select the Nearest Neighbourhood

method

What is the value of the red pixel if you use the bilinear interpolation method

What is the value of the red pixel if you use the bicubic interpolation

Answer 1:

Correct!

10

Answer 2:

Correct!

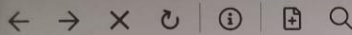
Between 10 and 20

Answer 3:

Correct!

It cannot be calculated

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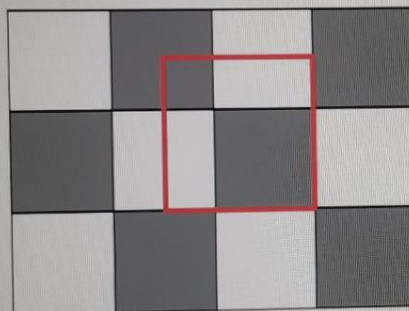


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Question 14

0.4 / 0.4 pts

The following figure shows a 3 by 4 image where the greyish cells have a value of 10 and the white cells a value of 20.



The original pixel size is 10 m. The final geocoded pixel is shown in red (only 1 is shown).

What is the value of the red pixel after geocoding if you select the Nearest Neighbourhood

method

What is the value of the red pixel if you use the bilinear interpolation method

What is the value of the red pixel if you use the bicubic interpolation

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Question 10 0.4 / 0.4 pts

Match each statement with the appropriate sensor/image characteristic.

Correct!	In band 6 I cannot discriminate the 2 different ice covers having a high spectral reflectance. This is due to a limited	Radiometric resolution ▼
Correct!	To study the growth cycle of the crop I need data with a higher	Temporal resolution ▼
Correct!	To discriminate between the two landcovers I need measurements in different parts of the spectrum; a sensor with appropriate	Spectral resolution ▼
Correct!	Detection of trees, to be able to count how many there are in the orchard, requires a higher	Spatial resolution ▼

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Question 13



This laser dot located at the Onze Lieve Vrouwetoren (church tower) in Amersfoort, is the central point of the Dutch map projection of the National Triangle Survey (with coordinates +155 000 m +463 000 m) RD datum. This is a curiosity. Now, assume that you have a raster image georeferenced in this coordinate system and you would like to be able to read UTM coordinates without changing the pixels and their values. Select the 2 correct possibilities. A wrong answer cancels a correct selected answer.

Directly change the coordinate system (EPSG) of the image to the one corresponding to UTM.

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Question 12

0.13 / 0.4 pts

Define which statements are correct in the following list. Select the (3) correct answers. An incorrect answer cancels a correct answer.

- ☒ **Correct!** The shape file actually consists of at least three different files that work together to store your digital vector data.
- ☒ **Correct!** The successive processing steps for automatic digitizing are scanning, map registration, skeletonizing, extracting vectors, data clean-up, and feature forming.
- ☐ A Web Map Service (WMS) generates a map as a vector file.
- ☐ The tolerance value for cleaning vector data must be larger than the accuracy of the data to avoid unacceptable displacements.
- ☐ **Correct answer** Semi-automatic on-screen digitizing of a printed map requires higher scan resolutions than manual on-screen digitizing of a printed map.
- ☐ **You Answered**

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Question 11

0.4 / 0.4 pts

A topographic map with a map scale of 1:10,000 has been registered using 4 grid intersection points. The Root Mean Squares Error (RMSE) of the map registration is approximately 10m meter. Is the level of error acceptable?

Select the ONE correct answer from the following list.

- ☐ The RMSE is not acceptable because the error in map units is 0.1mm which is larger than the typical accuracy of a topographic map.
- ☒ **Correct!** The RMSE is not acceptable because the error in map units is 1mm which is larger than the typical accuracy of a topographic map.
- ☐ The RMSE is acceptable because the error in map units is 1mm which is smaller than the typical accuracy of a topographic map.
- ☐ The RMSE is acceptable because the error in map units is 0.1mm which is smaller than the typical accuracy of a topographic map.

Select the correct statement from the following list The total optical air mass can be obtained by calculating the sum for each layer

Assume that the transmissions of layers 0-3 are 0.96, 0.94, 0.91, and 0.88. Calculate the total transmission of the medium. Note that the value of layer 3 given here is not the correct answer to the next question. The total transmission is 0.72

Answer 1:

Correct! The total optical air mass can be obtained by calculating the sum for each layer

Answer 2:

Correct! 0.72

0 / 0.2 pts

Question 7

Use the information provided in the previous question and table. Calculate the transmission of layer 3. Round the answer to 2 decimals.

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Question 9 0 / 0.4 pts

Select the one correct answer from the following list.

You Answered

☒ The period of the orbit of a satellite in sun-synchronous orbit is 24 hrs

☐ A geostationary satellite can have an orbit with inclination between 80o and 100o and an altitude of approximately 35786km above the Earth surface

Correct answer

☐ A sensor x on a satellite with orbit altitude of 600km measures a smaller Ground Resolution Cell size than the same sensor on a satellite in orbit at 800km

☐ To study the North polar region in detail we can use satellites in a geostationary orbit

0.4 / 0.4 pts

Question 10

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Correct Answers Between 0.94 and 0.96

Question 8 0.2 / 0.2 pts

Select the one correct statement from the following list.

- ☐ In the atmospheric window regions, no scattering occurs
- ☒ For Mie scattering, more forward scattering occurs for larger particles
- ☐ Scattering of red laser light on milk molecules causes the liquid to heat up a tiny bit
- ☐ During daytime, the sky appears blue to our eyes because most of the red light is scattered out of the direct solar beam by the Rayleigh scattering process

Question 9 0 / 0.4 pts

Correct! The total optical air mass can be obtained by calculating the sum for each layer

Answer 2:

Correct! 0.72

Question 7 0 / 0.2 pts

Use the information provided in the previous question and table. Calculate the transmission of layer 3. Round the answer to 2 decimals.

You Answered 0.72

Correct Answers Between 0.94 and 0.96

Question 8 0.2 / 0.2 pts

Select the one correct statement from the following list.

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Question 3

0.15 / 0.15 pts

The photon energy is related to the wavelength of radiation according to: $Q = \frac{hc}{\lambda}$

Select the one correct statement from the following list.

- ☐ With decreasing wavelength, photon energy decreases.
- ☐ h is a constant with the value of $300 \cdot 10^3 \text{ ms}^{-1}$
- ☒ If $\lambda = 532 \text{ nm}$: $Q = 3.74 \cdot 10^{-19} \text{ J}$

Correct!

Question 4

0.15 / 0.15 pts

The photon energy is related to the wavelength of radiation according to: $Q = \frac{hc}{\lambda}$

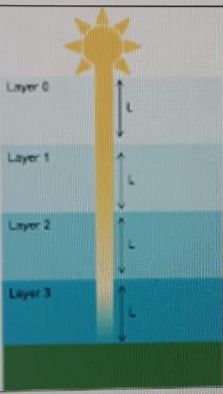
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Question 6

0.4 / 0.4 pts

Consider a medium consisting of N layers of length L , varying density (ρ) and extinction coefficient (k). The values and a sketch of the situation are given in the Table below.

Layer	L	ρ	k
0	2000	0.01	$6 \cdot 10^{-4}$
1	2000	0.02	$5 \cdot 10^{-4}$
2	2000	0.04	$4 \cdot 10^{-4}$
3	2000	0.08	$3 \cdot 10^{-4}$



Select the correct statement from the following list The total optical air mass can be obtained by calculating the sum for each layer

Assume that the transmissions of layers 0-3 are 0.96, 0.94, 0.91, and 0.88. Calculate the total transmission of the medium. Note that the value of layer 3 given here is not the correct answer to the next question. The total transmission is 0.72

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Question 5 0 / 0.5 pts

Kirchoff's law dictates that $L_{in} = L_E + L_T + L_R$ (with L_{in} the incoming, L_E the emitted, L_T the transmitted, and L_R the reflected radiative flux).

Answer the following sub questions. Ensure that in your answer you indicate which sub question (a, b or c) you answer.

a) A real body receives 10 Wm^{-2} of irradiance. The body is opaque (not transparent) and reflects 80% of the incoming radiation. Calculate the radiative flux emitted by the body L_E . Show your calculation.

b) What is the emissivity of the real body? Show your calculation.

c) What happens to the body if $L_{in} > L_E + L_T + L_R$? Your answer should be short, a single sentence should suffice.

Your answer:

a.

b.

c. Some radiation must have been absorbed in the body.

0.4 / 0.4 pts

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☐ h is a constant with the value of $300 \cdot 10^{-9} \text{ ms}^{-1}$

Correct!

☒ If $\lambda = 532 \text{ nm}$: $Q = 3.74 \cdot 10^{-19} \text{ J}$

Question 4 0.15 / 0.15 pts

The photon energy is related to the wavelength of radiation according to: $Q = \frac{hc}{\lambda}$

Select the one correct statement from the following list.

Correct!

☒ If Q is known, λ can be calculated

☐ λ is the frequency of radiation given in s^{-1} (or Hz)

The unit of Q is $\text{Wm}^{-2}\text{sr}^{-1}$

Question 5 0 / 0.5 pts

Question 1

0.5 / 0.5 pts

Indicate whether the following statements are true or false.

Delaunay triangulations use discrete triangles as a means of representation. They are therefore unsuitable to represent continuous phenomena. [Select]

Lines can be used to represent both discrete and continuous phenomena.

[Select]

Temperature records may fall below 0, therefore you cannot represent this variable using a ratio scale of values. [Select]

The mathematical expression:

$\text{interior}(\text{blue}) \cap \text{interior}(\text{green}) \neq \emptyset \wedge$

$\text{boundary}(\text{blue}) \cap \text{boundary}(\text{green}) \neq \emptyset \wedge$

$\text{interior}(\text{blue}) \cap \text{boundary}(\text{green}) \neq \emptyset \wedge$

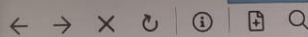
$\text{boundary}(\text{blue}) \cap \text{interior}(\text{green}) = \emptyset$

correctly expresses the topological relationship between the following 2 sets



[Select]

By definition, a point has zero dimensions. This property is well preserved in the vector model, but not in the raster model, where the smallest unit of representation is bi-dimensional.



Select the one correct statement from the following list:

☐ L12 is topologically inconsistent because it breaks the following rule: "1-simplices only intersect at their (bounding) nodes".

☐ A disjoint C is a non-topological feature of this model

Correct!

☒ P12 inside B is a topological feature of this model

The following line does not belong to the model:

Line	From	To	Left	Right
L7	P6	P5	B	C

Question 2 0.4 / 0.4 pts

Below you see a simple boundary model.

Select the one correct statement from the following list:

L12 is topologically inconsistent because it breaks the following rule: "1-simplices only intersect at their (bounding) nodes".

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HELP CENTER

By definition, a point has zero dimensions. This property is well preserved in the vector model, but not in the raster model, where the smallest unit of representation is bi-dimensional.

[Select]

Answer 1:

Correct! False

Answer 2:

Correct! True

Answer 3:

Correct! True

Answer 4:

Correct! False

Answer 5:

Correct! True