

Q1. Classify the following attributes as:

1) nominal, ordinal, interval, or ratio; and 2) as binary, discrete, or continuous. Some cases may have more than one interpretation, so briefly justify your answer if you think there may be some ambiguity.

(a) (1 point) Temperature in kelvin (absolute temperature scale)

Ratio, Continuous

The temperature scale in Kelvin is a **Ratio** scale variable because it possesses an absolute zero which is at -273.15 degree Celsius. So, any object at 20 degree Kelvin is said to be twice as hot as another object at 10 degree Kelvin. Temperature in Kelvin is **Continuous** because it can assume any real values from -273 degrees to positive infinity.

(b) (1 point) Temperature in degrees Celsius

Interval, Continuous

The temperature scale in Celsius is the **Interval** scale variable because the difference between measurements is the same anywhere along the scale, and is consistent across measurements. The temperature scale in Celsius also doesn't assume a true zero point and hence cannot be categorized as a Ratio. The values are **Continuous** as they can assume any real values from -273 degrees to positive infinity.

(c) (1 point) True or False

Nominal, Binary

The options True or False do not include the concept of measuring anything and hence is not an interval or ratio attribute. Also considering the fact that the order of True or False wouldn't actually indicate any natural ordering, it wouldn't be an ordinal attribute either. The values True or False correspond to some categorical values and hence can be categorized as **Nominal**. The value True or False is **Binary** as it represents two specific values.

(d) (1 point) Placement in a race (E.g. First, Second, Third, etc.)

Ordinal, Discrete

The placement/position in a race do have an order, but the numerical difference between different values is not consistent or quantifiable. Hence, it is categorized as **Ordinal**. These values are **Discrete** as the categories are countable and are finite in number.

(e) (1 point) Speed in miles per hour

Ratio, Continuous

Speed in miles per hour is a **Ratio** scale variable because at any point in time, the speeds are comparable. Using the same scale, two speeds will have the same ratio. Speed in miles per hour would be a **Continuous variable** as there is always a possibility to obtain a value between any two speed values. It would be quite impossible to count all of the possible speeds that could be.

(f) (1 point) Number of Legos in a set

Ratio, Discrete

Number of legos in a set is a **Ratio** variable as it involves the count of any object and in that case both the differences as well as ratio both are meaningful. Given the fact that the count of any object can either be finite or countably infinite, the number of legos in a set is **Discrete**.

(g) (1 point) Time of the day to the nearest minute

Interval, Discrete

Time is considered an **Interval** variable because differences between all time points are equal but there is no “true zero” value for time. Since the time of the day to the nearest minute is either finite or can be categorized as countably infinite, it would be classified as a **Discrete** variable.

(h) (1 point) First Name

Nominal, Discrete

The values for the first name are **Nominal** because they just serve the purpose of labeling variables and don't quantify any value. Since the first names can be assumed to be countably infinite, we can classify the First Name attribute to be **Discrete**.

(i) (1 point) Product Satisfaction Rating (Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied)

Ordinal, Discrete

When we speak about the rating, we are more interested for the order of the ratings provided and not any mathematical interpretation like the difference between the corresponding values. Hence the order is what matters more and therefore the product satisfaction rating attribute would be categorized as **Ordinal**. The Product Satisfaction Rating aims at providing Since the rating values can have finite values to be selected, hence it can be categorized as **Discrete**.

(j) (1 point) Ocean depth in meters

Ratio, Continuous

The depth of the ocean can be visualized as a length parameter (here the difference and ratio both seem meaningful) which is simply considered to be a **Ratio** attribute value. There are so many different depth levels of the ocean, it is pretty much impossible to calculate the average depth unless every part of the ocean is measured. Thus it will be considered as **Continuous**.

(k) (1 point) Points scored in a game of basketball

Ratio, Discrete

The points scored in a game of basketball is a **Ratio** as the difference or ratio between any two values would always be meaningful. It is only possible for a team's score to be a whole number—no fractions or decimals are allowed, and also given the fact that the values can be considered to be finite or countably infinite, the points scored in a game of basketball will be **Discrete**.

(l) (1 point) Average points scored in a game of basketball over a career

Ratio, Continuous

The average points scored in a game of basketball is a ratio since again the difference or the ratio between any two values would always be meaningful. It is only possible for a team's score to be a whole number—no fractions or decimals are allowed but the average score of the points may be a floating value and hence is **Continuous**.

(m) (1 point) Letter grade in a class (E.g. A+, A, A-, B+, B, etc.)

Ordinal, Discrete

The letter grade in a class is ordinal because we are more interested in the order of the letter grades provided and not any mathematical interpretation like the difference between the corresponding values. Hence the order is what matters more and therefore the letter grades in a class would be categorized as **Ordinal**. These values are **Discrete** as the grades are countable and are finite in number.

(n) (1 point) Open or Closed

Nominal, Binary

The options Open or Closed do not include the concept of measuring anything and hence is not an interval or ratio attribute. Also considering the fact that the order of Open or Closed wouldn't actually indicate any natural ordering, it wouldn't be an ordinal attribute either. The values Open or Closed correspond to some categorical values and hence can be categorized as **Nominal**. The value Open or Closed is **Binary** as it represents two specific values.

(o) (1 point) Pages in a book

Ratio, Discrete

The pages in a book are a **Ratio** variable as it involves the count and in that case both the differences as well as ratio both are meaningful. Given the fact that the count of any object can either be finite or countably infinite, the pages in a book in a set are **Discrete**.

(p) (1 point) Result of the roll of a dice

Nominal, Discrete

The die faces are essentially labels and could reasonably be considered **nominal**. For each face of a dice, the action associated is distinct and taking this scenario into account, we can say the result of a roll of a dice being distinct would make it **Nominal**. Discrete variables assume values that can be counted and are whole numbers and since rolling two dice involves only whole numbers, the data is **Discrete**.

(q) (1 point) Email address

Nominal, Discrete

The email addresses are all expected to be distinct in nature and they just serve the purpose of labeling variables and don't quantify any value. Thus email addresses would be classified as **Nominal**. Since the email addresses can be assumed to be countably infinite, we can classify the email address attribute to be **Discrete**.

(r) (1 point) Amount of calories in a food

Ratio, Continuous

The unit of calories means the same thing on all parts of the scale. A value of zero calories means an absence of energy and thus a true zero exists for this attribute. At any point of time the difference or the ratio between any two calorific values would always be meaningful and hence is **Ratio**. It is possible for calories to assume floating values instead of whole numbers and thus is classified as **Continuous**.

(s) (1 point) Size of house in square feet

Ratio, Continuous

The size of a house is always associated with length and depth parameters which automatically classifies it to be a **Ratio** attribute. It is possible for the dimensions of a house to assume floating values instead of whole numbers and thus is classified as **Continuous**.

(t) (1 point) Cumulative grade point average

Ordinal, Discrete

The cumulative grade point average is something whose additive or multiplicative inferences do not satisfy the actual mathematical calculation. So interval and ratio can be striked off easily. And also since CGPA always satisfies a particular order within itself we can say that CGPA can be taken as **Ordinal**. Also the values of CGPA can be taken as countably infinite for a particular range, it is classified as **Discrete**.