

**BOCCONI UNIVERSITY**

**GRADUATE INTERNATIONAL**

**Simulation test**

**1.24**

**Consider the following passage when answering the next question**

The electoral system in the United States is not one of proportional representation but rather a majority electoral one. This means that the one who wins gets the whole **loot**: for example, the one who wins in California, even if just by a few votes, clinches all 58 great electors for that state and the runner-up scores none. The states of Nebraska (which casts 5 great electors) and Maine (which casts 4) are exceptions to this rule. There, a proportional system rules by which the great electors are assigned in proportion to the votes actually received. This explains why it can occur that a president be elected when, as a candidate, he/she obtained fewer votes than his/her opponent in America as a whole but won, even if by only a little, in states which have a greater number of great electors available to them. This is just what happened with Trump and Clinton in the 2016 election.

**1. According to the passage, what does the author refer to when writing “loot”?**

1. The United States Congress
2. All the great electors of a state
3. The presidency
4. The spoils

**Choose answer choice:**

- A. if statement (1) BY ITSELF is sufficient to answer the question, but statement (2) by itself is not or vice versa
- B. if statement (1) and (2) TAKEN TOGETHER are sufficient to answer the question, even though NEITHER statement BY ITSELF is sufficient
- C. if either statement BY ITSELF is sufficient to answer the question
- D. if statement (1) and (2) TAKEN TOGETHER are NOT sufficient to answer the question, requiring more data pertaining to the problem

**2. A list of student scores on a university exam consists of 400 different numbers, where each score is a number on the list.**

**Is the arithmetic mean of the numbers in the list greater than the median of the numbers in the list?**

**Statement (1)** Of the students that took the exam, 280 scored less than the arithmetic mean.

**Statement (2)** Of the students that took the exam, 30% scored higher or equal to the arithmetic mean.

1. A
2. B
3. C
4. D

**3. The gradient of the function  $z = f(x,y) = x \ln y - y \ln x$ :**

1. is  $[\ln y - y/x ; x/y - \ln x]$
2. is  $[x/y - \ln x ; \ln y - y/x]$
3. does not exist as logs are not defined for negative arguments
4. is a 3-vector containing the partial derivatives of the function with respect to  $z, x, y$

Consider also the table below when answering the next question

Income bracket, average annual income, number of taxpayers, and relative rate of taxation in Belgium

Income bracket	Average annual income	Number of taxpayers	Rate of taxation
€10-20 thousand	€12,000	8,000,000	7%
€21-30 thousand	€25,000	16,000,000	15%
€31-50 thousand	€43,000	18,000,000	20%
€51 thousand and over	€138,000	4,000,000	15%

4. Matthew declares an income of €45,000 and Luke one of €60,000.

Knowing that in Italy, Matthew would be taxed at 25% and Luke at 20%, who saves more by staying in Belgium?

1. Luke, who saves €3,000
2. Luke, who saves €4,500
3. Matthew, who saves €2,000
4. Luke, who saves €2,250

Choose answer choice:

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5. A car wheel is rolling on a road in a straight line without slipping.

What is the number of 360-degree rotations that it will make in 100 meters?

Statement (1) The diameter of the wheel, including the tire, is 0.5 meter.

Statement (2) The wheel made three 360-degree rotations per second.

1. A
2. B
3. C
4. D

Carefully read the following data and statements and answer the next question

#### DATA

All the objects on the shelf are wooden except for one  
 If a candle is on the shelf, it is red  
 Each wooden object on the shelf represents an animal  
 There are no red plastic animals on the shelf

#### STATEMENTS

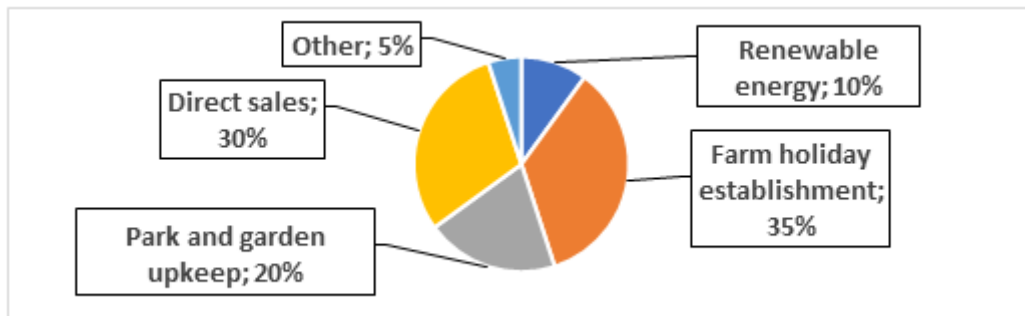
- A. There is a red candle on the shelf
- B. There are no white candles on the shelf
- C. There are no plastic animals on the shelf
- D. There is a wooden angel on the shelf

6. Based on the above data, which statement(s) is/are necessarily true?

1. Only C
2. Only B
3. Only A
4. Both B and D

Consider also the graph below when answering the next question

Companies in Veneto with a side business alongside agriculture



7. Knowing that:

- there are 30 companies which produce renewable energy as a side business
- 30% of the companies which do direct sales as a side business sell only fruit
- 20% of the companies which are farm holiday establishments as a side business are in the province of Rovigo

how many companies are there which are farm holiday establishments as a side business and are not in the province of Rovigo?

1. 84
2. 90
3. 105
4. 120

Read carefully

A product which represents clear technological progress can usually require that buyers pay a rather high price. Given that **technological progress tends to be surpassed quickly** and companies want to make the greatest possible profits while they can, **many companies decide to ask for the highest possible price**. However, a new product which generates large profits gives competitors a great incentive to reproduce its characteristics quickly. As a consequence, the best strategy to maximize profit from a new product is to ask for just under the highest possible price.

8. What is the function of the two phrases highlighted in bold in the passage?

1. The first is a consideration in support of an argument for why a certain strategy is counterproductive and the second describes the strategy itself
2. The first is a consideration which explains the consequences of the strategy recommended in the passage and the second describes the strategy itself
3. The first is a consideration which explains why a strategy has been chosen and the second describes the strategy itself
4. The first is a consideration used to justify the choice of a certain strategy and the second describes the goal that strategy aims to achieve

9. The  $p$ -value in a hypothesis test is:

1. the probability that the null hypothesis is true
2. the probability of committing a Type I error
3. one less the power of the test
4. none of the other answers is correct

**Consider the following passage when answering the next question**

A strip of mauve light rimmed by green - that is how STEVE (Strong Thermal Emission Velocity Enhancement) appears, an optical phenomenon discovered by astronomers in 2018. It distinguishes itself clearly from auroras, which are typical of the more extreme latitudes, and now a study by NASA excludes the possibility that they have to do with airglow, a luminescent phenomenon of the atmosphere. So, what is it? Auroras are phenomena caused by the interaction between charged particles coming from the Sun and Earth's magnetic field which is displayed near magnetic poles. On the other hand, airglows are caused by specific chemical phenomena and occur at all latitudes. "STEVE does not appear to line up with either of these two types of phenomena," says Joshua Semeter, professor at Boston University. STEVE is visible at southern latitudes and can also be distinguished from auroras by its predominant mauve-pink coloration. One study argues that it has to do with extremely hot particles connected to some phenomenon which can be connected to Earth's upper atmosphere, but the mystery is yet to be solved.

**10. According to the passage, what differentiates STEVE from airglow?**

1. Its specific coloring
2. Its visibility at primarily southern latitudes
3. The temperature of its particles
4. It cannot be deduced from the passage

**Choose answer choice:**

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- B. if statement (1) and (2) TAKEN TOGETHER are sufficient to answer the question, even though NEITHER statement BY ITSELF is sufficient
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**11. In a triangle with vertices *A*, *B* and *C*, what is the length of *BC*?**

**Statement (1)** The length of *AB* is 8.

**Statement (2)** The length of *AC* is 15.

1. A
2. B
3. C
4. D

**Carefully read the following data and statements and answer the next question**

**DATA**

All of Andrew's friends are blond  
 Lucy is Andrew's cousin and has blue eyes  
 If a male friend of Andrew's has blue eyes, then he is tall  
 Mark is a friend of Andrew's and he has green eyes

**STATEMENTS**

- A. Mark is short
- B. Lucy is blond and tall
- C. Mark is dark-haired
- D. Mark is blond

**12. Based on the above data, which statement(s) is/are necessarily false?**

1. Only C
2. Only B
3. Only A
4. Both B and C

Consider also the table below when answering the next question

Recycled materials in 5 Italian regions (data in tons)

	<i>Glass</i>	<i>Plastic</i>	<i>Paper</i>	<i>Undifferentiated waste</i>
Lazio	98	134	67	145
Lombardy	122	176	122	60
Molise	23	45	32	41
Tuscany	78	95	87	45
Veneto	109	134	99	34

13. The region of Piedmont has a total quantity of recycled materials which is 20% more than that of Lombardy, but in a ratio with glass, plastic, paper, and undifferentiated waste of 2:3:2:1, respectively. How many tons of plastic does Piedmont recycle?

1. 216
2. 240
3. 144
4. 250

Read carefully

An international study has shown that a diet which includes at least 3 meals containing fruit or vegetables per day noticeably reduces the risk of obesity. The study claims that only 9% of those who follow such a diet become obese (that is, have a Body Mass Index greater than 30) and that only 6% have a high level of glycemia or triglycerides in their blood.

14. Which of the following statements, if true, would most weaken the arguments reported in the passage?

1. High levels of triglycerides in the blood are associated with greater cardiovascular risk
2. Those who eat fruit but not vegetables are two times more at risk of inflammation compared with those who eat vegetables but not fruit
3. Vegetables and fruit are a source of important fiber and vitamins, and are rich in antioxidants
4. 8% of those who do not eat at least 3 meals a day containing fruit or vegetables have a Body Mass Index greater than 30

Choose answer choice:

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- C. if either statement BY ITSELF is sufficient to answer the question
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15. The Kidz Company produces toys.

What is the ratio of the number of teddy bears to the number of wooden trains produced by the Kidz Company last year?

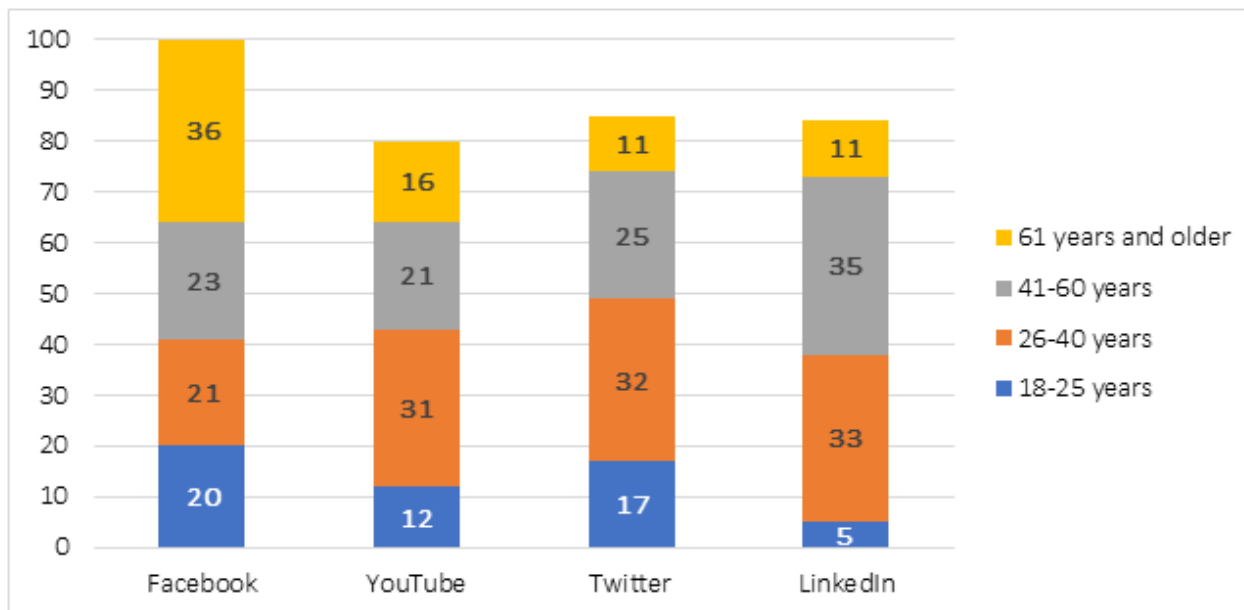
**Statement (1)** Last year, if the number of teddy bears produced by the Kidz Company had been 8% greater, the number of teddy bears produced would have been 150% of the number of wooden trains produced by the Kidz Company.

**Statement (2)** Last year the Kidz Company produced 15,300 wooden trains and 10,250 teddy bears.

1. A
2. B
3. C
4. D

Consider also the graph below when answering the next question

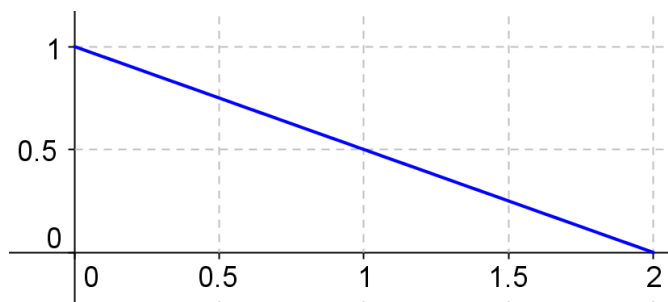
Number of registered users on a social network, divided by age (data in million)



**16. Registered users:**

1. of Facebook are 50% in the age group 61 years and older
2. aged 26-40 sign up on Twitter more than on LinkedIn
3. on Twitter and YouTube have the same percentage distribution
4. of Facebook and Twitter, aged 18-25 years, make up the same percentage of total registered users on the respective social network

**17. Let  $X$  be a continuous random variable; its probability density function is shown below.**



Then:

1. the expected value of  $X$  is equal to 1
2. the probability that  $X$  is greater than 1 is greater than 0.5
3. the probability that  $X$  is greater than 1 is less than 0.5
4. the expected value of  $X$  is greater than 1

**18. In a symmetric distribution:**

1. the mean is smaller than the median
2. the mean is greater than the median
3. the mean and median coincide
4. the variance is equal to one

Consider the following passage when answering the next question

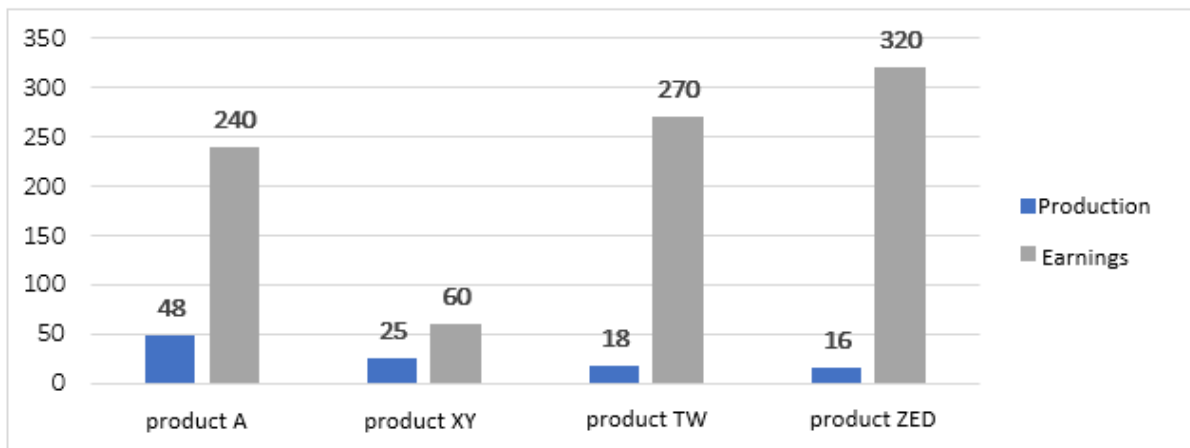
For Hegel, nature does not display freedom, but rather only randomness and necessity, and even if it is subject to external laws, this does not save it. Nature, in fact, is only the externalization of the idea being outside of itself and is dispersed in space and time. It is a kind of decline of the idea, even if Hegel justifies it as a necessary stage toward reaching the spirit's self-consciousness. Hegel says no more: he sees that nature exists, but he does not explain why it exists.

19. According to the passage, which of the following statements is consistent with Hegel's thought?

1. Nature is the manifestation of the idea in time and space
2. Nature is the necessary elimination of the idea
3. The expression of the idea in nature impedes the spirit's self-consciousness
4. No connection exists between the consciousness of the spirit and the expression of nature

Consider also the graph below when answering the next question

Production (in hundreds) and total profit (in thousands of Euro) related to Flexxy products



20. Knowing that the unit cost of production is equal for all the products mentioned, which Flexxy product obtains the highest revenue per unit?

1. Product A
2. Product XY
3. Product TW
4. Product ZED

Carefully read the following data and statements and answer the next question

**DATA**

In the drawing all the colors are light  
 Some of the drawing's subjects are animals  
 If there is a white dog in the drawing, then there are also three white cats  
 In the drawing there are no plants

**STATEMENTS**

**A.** In the drawing there are no light-colored trees  
**B.** In the drawing there is a white dog  
**C.** In the drawing there is a light-colored animal on a dark background  
**D.** In the drawing there are no dark cats

21. Based on the above data, which statement(s) is/are necessarily true?

1. Only D
2. Only B
3. Only A
4. Both A and D



**Choose answer choice:**

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- B. if statement (1) and (2) TAKEN TOGETHER are sufficient to answer the question, even though NEITHER statement BY ITSELF is sufficient
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**22. After losing 50% of the first 20 matches he played, tennis player L.S. lost all of the remaining matches he played.**

**What was the total number of matches that L.S. lost?**

**Statement (1)** L.S. played 25 matches in total.

**Statement (2)** L.S. lost 60% of all the matches he played.

- 1. A
- 2. B
- 3. C
- 4. D

**Read carefully**

There is an optical illusion, known as “the size-speed illusion”, which makes it so that the larger an object is, the more it seems to move slowly. So, a motorcyclist who must decide whether to cross an intersection or not while a truck is approaching from the right will be more inclined to cross compared with the situation in which an automobile is approaching from the right.

**23. The conclusion described above can be deduced more correctly if the passage states explicitly that:**

- 1. the truck’s speed is actually greater than that of the automobile
- 2. the speed of the truck is assumed to be equal to that of the automobile
- 3. the truck’s speed is lower than that of the automobile
- 4. the motorcyclist’s assessment is assumed to be more accurate with objects in motion rather than with objects at rest

**Consider also the table below when answering the next question**

Number of students enrolled in 3 degree programs at the University of Padua (academic year 2022/2023)

	<i>Sociology</i>	<i>Law</i>	<i>Political Science</i>
1 <sup>st</sup> Year	2,400	2,590	2,900
2 <sup>nd</sup> Year	1,890	1,900	1,200
3 <sup>rd</sup> Year	1,200	1,505	1,409

**24. In academic year 2021/2022, the number of students enrolled in the first year of Sociology was equal to 2,700.**

**Assuming that the percentage decrease of enrolled students between the first and second year of enrollment is constant, how many students will enroll in the second year of Sociology at the University of Padua in academic year 2023/2024, knowing that there will be no new enrollments from other universities?**

- 1. 1,680
- 2. 1,825
- 3. 1,660
- 4. 1,510

Choose answer choice:

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25. For each wall painting that takes more than 4 hours, a certain street artist charges a total of  $x$  Euro for the first 4 hours plus  $0.2x$  Euro for each additional hour or fraction of an hour, where  $x > 100$ .

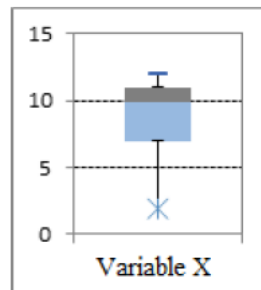
Did a particular wall painting take more than 10 hours?

Statement (1) The street artist charged a total of 288 Euro for the wall painting.

Statement (2) The street artist charged a total of  $2.4x$  Euro for the wall painting.

- 1. A
- 2. B
- 3. C
- 4. D

26. Consider the following box plot relative to the variable  $X$ :



Then:

- 1. the mean of  $X$  is 10
- 2. the mean of  $X$  is greater than 10
- 3. the mean of  $X$  is less than 10
- 4. the mean of  $X$  is 1

27. In the population of a certain European region the percentage of graduates is 80%. By choosing two people randomly, what is the probability that both are not graduates?

- 1. 20%
- 2. 40%
- 3. 4%
- 4. 64%

Carefully read the following data and statements and answer the next question

**DATA**

In the mural there are only colored geometric shapes  
 In the mural every red circle is inside a blue square  
 In the mural there are no red triangles  
 In the mural, if a circle is not red, it contains a triangle

**STATEMENTS**

**A.** In the mural there are no empty blue squares  
**B.** In the mural, every blue circle contains a red triangle  
**C.** In the mural, every non-red circle contains a non-red triangle  
**D.** In the mural, every blue square contains a red circle which contains a red triangle

28. Based on the above data, which statement(s) is/are necessarily false?

1. Only D
2. Only B
3. Only A
4. Both B and D

**Read carefully**

Bioengineering has been employed to develop cotton plants which are capable of producing their own insecticide against parasites (which usually damage harvests significantly) and, in fact, up to this year parasites have not brought great losses to cotton crops. This year, however, crops have been seriously damaged by parasites; but that does not necessarily mean that parasites have developed a resistance to cotton insecticide. Parasites also grow on corn, in fact, and last year more corn than usual was planted in the areas where cotton is grown. So, it is possible that cotton was simply damaged by parasites which grew on corn plants.

29. Which of the following information would be most useful for assessing the argument reported above?

1. Whether bioengineering could also be used on corn plants to produce a natural insecticide
2. Whether this year the cotton plants which do not produce the insecticide are suffering unusual damage due to parasites
3. Whether other crops which have used bioengineering to produce insecticide hold up against the parasites
4. Whether the cotton plants which used bioengineering experience frequent damage from other insects, beyond the parasites

30. Let us suppose that the percentage of foreign students attending the universities of a certain country is 20%. Three students are selected at random.

The probability that none of the three is foreign is:

1.  $(0.2) * (0.8) * (0.16)$
2.  $2 * (0.2)^2 * (0.8)$
3.  $(0.8)^3$
4.  $3 * (0.8)^3$

**Consider the following passage when answering the next question**

The circular economy is a new business model which replicates the natural life cycle: for every end there is a new beginning. Products are designed to get a new life thanks to repairs, reconstruction, and transformation. Circularity means being aware of the water and energy consumption required in production. Passage from agriculture-based economies to capitalism has been a path of growth and technological innovation, but also of waste and exploitation. Externalities such as waste and pollution have been ignored by traditional business, but, on the contrary, they are taken into account by the circular economy. It is a cycle of learning achieved through a reevaluation of the idea of recycling and reusing, going from being a way to respond to the needs of the agriculture-based economies to conceiving of sustainability as the focal point of the economy.

**31. According to the passage, it is correct to state that this passage is:**

1. a prescriptive piece
2. an expository piece
3. a scientific report
4. a recreational piece

**Consider also the table below when answering the next question**

Fruit and vegetable production in 4 Italian regions (data in tons)

	<i>Citrus fruits</i>	<i>Olives</i>	<i>Grapes</i>	<i>Apples</i>
Lazio	45	54	96	32
Sicily	120	65	87	2
Tuscany	12	78	98	24
Veneto	3	87	102	46

**32. Knowing that:**

- production in Molise of the 4 products cited is equal to 100 tons
- the production of apples in the 4 regions cited represents 40% of national production
- the production in Lazio of the 4 products cited represents 40% of total fruit and vegetable production
- the production of citrus fruits in Sicily represents 50% of national production
- the region Molise reports the same production of olives as Lazio, the same production of apples as Tuscany, and 5% of national production of citrus fruits

**how much does the production of grapes in Molise amount to?**

1. 10 tons
2. 15 tons
3. 20 tons
4. 45 tons

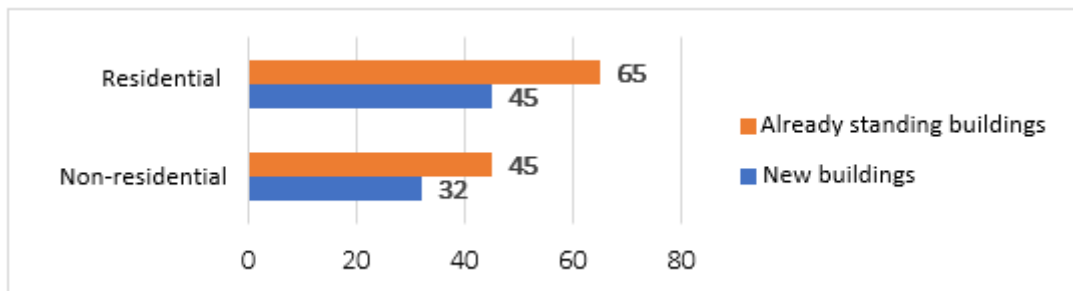
**33. Consider the intervals of real numbers  $(a,b)$  and  $(c,d)$  with  $a < c$ .**

**Then:**

1. the intervals are disjoint
2. their intersection is not empty
3. their intersection is closed
4. their intersection is open

Consider also the graph below when answering the next question

Number of building permits in the year 2019 in the province of Milan (data in thousands)



34. Knowing that the number of permits:

- to construct new buildings in 2020 will double compared with 2019
- to construct new residential buildings is for 1/3 of its total related to downtown Milan
- to construct already standing buildings in the province of Milan represents 5% of permits at the national level

what is it correct to affirm in this regard?

1. In 2020 the number of permits to construct new buildings will be greater than that to construct already standing buildings
2. In 2019 there are 40,000 permits to construct new residential buildings which are not for downtown Milan
3. In 2019 there are 2,100,000 permits to build at the national level
4. In 2019 the number of permits to construct new buildings in the province of Milan is 3.5% of that at the national level

**Read carefully**

Usually scientists decide to be in this profession because they want to do innovative research and they recognize as their colleagues only those who are motivated by similar reasons. So, when a scientist becomes known as a popularizer of science, many colleague scientists think that this “mere communicator” should not be considered one of them.

35. The argument above is based on the assumption that:

1. serious research is the fruit of teamwork, not of individual work
2. scientists tend not to recognize as colleagues those people who achieve notoriety
3. a scientist could achieve notoriety without ever having done significant work in research
4. scientists believe that those who are known as popularizers of science are not interested in doing innovative research

36. A random number  $X$  assumes values 0 and 1 with equal probability.

Which of the following statements is true?

1. The value of  $X$  is positive with a probability of 1
2. The expected value of  $X$  is 1 because 1 is the highest value  $X$  can assume
3. If  $X$  is a random sum of money, a risk-averse assessor assigns it a certain equivalent of less than 0.5
4. The random number  $Y = 1/X$  has a finite expected value

**Choose answer choice:**

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- B. if statement (1) and (2) TAKEN TOGETHER are sufficient to answer the question, even though NEITHER statement BY ITSELF is sufficient
- C. if either statement BY ITSELF is sufficient to answer the question
- D. if statement (1) and (2) TAKEN TOGETHER are NOT sufficient to answer the question, requiring more data pertaining to the problem

**37. Among a group of 30 friends that meet up for dinner, 21 showed up late and 15 brought drinks. How many of the friends did not show up late nor bring drinks to the dinner?**

**Statement (1)** 12 of the 30 friends showed up late and brought drinks to the dinner.

**Statement (2)** 24 of the 30 friends showed up late or brought drinks to the dinner, or both.

- 1. A
- 2. B
- 3. C
- 4. D

**Carefully read the following data and statements and answer the next question**

**DATA**

Anne reads a different literary genre every day except on Sundays  
In a week, Anne dedicates three days to reading comic books  
Anne never reads novels on Tuesdays and Thursdays  
If it is Wednesday, then Anne reads a mystery

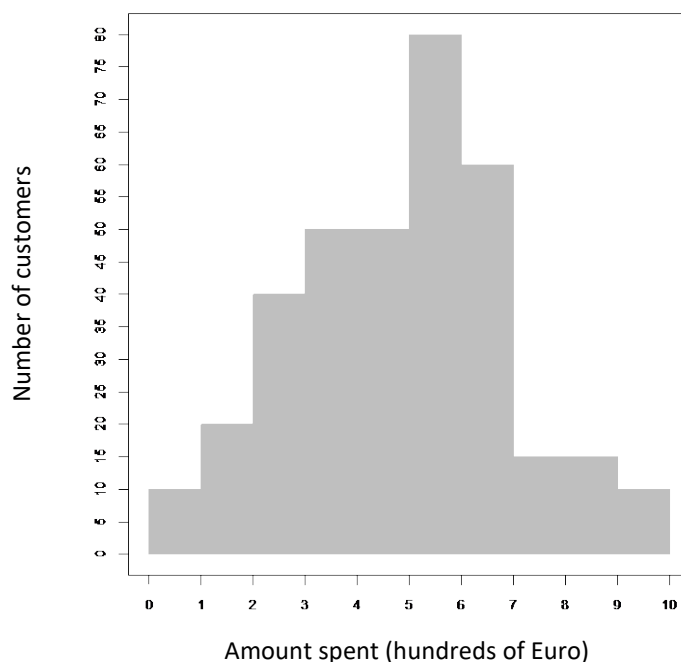
**STATEMENTS**

- A. On Tuesdays Anne reads a comic book
- B. On Sundays Anne does not read a novel
- C. On Wednesdays Anne does not read
- D. Only on Wednesdays Anne reads a mystery

**38. Based on the above data, which statement(s) is/are necessarily false?**

- 1. Only C
- 2. Only B
- 3. Only A
- 4. Both A and C

39. The chart below shows the distribution of the values of the variable “amount spent in the clothing department (in hundreds of Euro) during the last visit” found for a sample of 350 customers of a shopping center.



What percentage of customers spent between €200 and €500 in the clothing department of this shopping center?

1. 55.2%
2. 34.5%
3. 40%
4. 50%

Choose answer choice:

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40. If  $a$  and  $b$  represent the length and the width, respectively, of a rectangle, with  $a > b$ , what is the perimeter?

Statement (1)  $2a + b = 40$

Statement (2)  $b + a = 25$

1. A
2. B
3. C
4. D