1 A researcher reported that men have 36 times the odds of drinking wine as compared to women. Which of the following statements must also be true?

A. Men have a higher risk of drinking wine as compared to women
B. Men have a lower risk of drinking wine as compared to women
C. Men have an equal risk of drinking wine as compared to women
D. The relationship between risk of drinking wine among men and risk of drinking wine among women cannot be determined from the information given

2 A researcher aims to examine the rate of Generalised Anxiety Disorder among all undergraduate students in Singapore In order to do so, he obtains a list of all undergraduate students in the National University of Singapore, and randomly selects 1000 students for his sample.

Given that the National University of Singapore is one of various universities in Singapore, which of the following statements is most likely to be true?

A. The researcher has committed the atomistic fallacy
B. The researcher has committed the ecological fallacy
C. The sample is representative of the target population
D. The sample is not representative of the target population

3 In order to determine public attitudes toward various social issues, a newspaper publication firm asks its readers to visit its website to participate in a poll. The poll addresses a different social issue each week. During the previous week, the following poll was found on the website:

Foreign companies should be allowed to participate in domestic political issues.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

The following week, the newspaper publication firm announced that 6 in 10 respondents either disagreed or strongly disagreed with the statement. The population to which the results of this poll can be generalised to is:

A. All readers of the newspaper
B. All readers of the newspaper who have visited the website
C. All readers of the newspaper who have participated in this particular poll
D. All readers of the newspaper who have participated in at least one of the polls

4 In a study in which house addresses were used as the sampling frame, which of the following situations would prevent the researcher from generalising the results of his or her study to a population of citizens and permanent residents?

I. The proportion of addresses with no one living inside of them is 10%
II. The proportion of addresses with no one willing to participate is 80%
III. The sample size is 500

A. I only
B. II only
C. III only
D. II and III only

5 In order to obtain a representative sample of all students in a particular university, a researcher positioned 10 research assistants at the entrance of all of its 10 faculties, and asked them to collect a sample consisting of 1000 opinions by interviewing the first student who entered at the start of each 5 minute mark. Each interview takes about 3 minutes.

After having collected the data, the researcher found that the demographics of the sample matched that of the target population on the following characteristics: age, gender, ethnicity, and major. All of these characteristics were argued to be important in influencing the results of the study.

Which one of the following statements is true?

A. The sample is representative because of its demographic characteristics
B. The sample is representative because of the sampling scheme used to obtain it
C. The sample is not representative because of its demographic characteristics
D. The sample is not representative because of the sampling scheme used to obtain it

6 In 2016, the Singapore population comprised 74% of Chinese ethnicity, 13% of Malay ethnicity, 9% of Indian ethnicity, and 3% of other ethnicities. A researcher stratified the population into these four ethnic groups, and obtained a simple random sample of 200 respondents within each group.

Which of the following statements is true?

A. The sample is representative of the Singapore population because the chance a Chinese individual is selected is the same as that a Malay individual is selected
B. The sample is representative of the Singapore population because the chance a Chinese individual is selected is greater than that a Malay individual is selected
C. The sample is not representative of the Singapore population because the chance a Chinese individual is selected is smaller than that a Malay individual is selected
D. None of the above

7 Among 1000 university students who consent to participate in an experiment, 700 are undergraduates and 300 are postgraduate students. The students are randomly assigned into control group of size 700 and treatment group of size 300.

The number of undergraduates in the treatment group is likely to be _____ the number of postgraduate students in the control group.

A. Less than
B. More than
C. Equal to
D. Cannot be determined

8 A multiple choice exam has 60 questions. Each question has 4 possible answers and only 1 answer out of the 4 possible answers is correct. To receive an A grade, one must answer 95% and above of the questions correctly. We know that 54 questions were answered correctly. What is the probability of receiving an A grade (rounding off to 3 decimal places), if one were to guess the remaining questions?

A. 0.169
B. 0.466
C. 0.500
D. 0.743

9 The probability that a particular coin gets heads is p. Given that $0.4 < p < 0.5$, and that a, b, and c represent the probabilities of the following events:

a: Getting one head and one tail from two coin throws,
b: Getting two heads and one tail from three coin throws, and
c: Getting one head and two tails from three coin throws,

Which one of the following statements must be true?

A. $a < b < c$
B. $b < c < a$
C. $b < a < c$
D. The relationship between a, b and c cannot be determined from the information given

10 The Distress Thermometer (DT) refers to a single-item self-report measure of emotional distress, and is used in outpatient cancer clinics to screen for emotional distress among cancer patients. In a sample of 105 cancer patients, researchers observed that 33 suffered from emotional distress.

After having received a cancer diagnosis, David was screened positive for emotional distress based on the DT. Given that the DT has a sensitivity of 0.88 and a specificity of 0.81, what is the probability that David was actually feeling distressed?

A. 0.88
B. 0.81
C. 0.67
D. 0.94

11 Eric, Freddie and Gavin are three students in a class of 55. A network is created with 55 vertices, and each vertex represents a student in this class. In this network, two vertices are adjacent if the corresponding students have each other's phone numbers, and are not adjacent otherwise. Some of the centrality measures are shown below.

	Degree Centrality Measure	Closeness Centrality Measure
Eric	0.315	1.23
Freddie	0.537	1.71
Gavin	0.611	2.34

Let N be the number of vertices which are adjacent to both Freddie and Gavin. What is the minimum value that N can take?

A. 2
B. 5
C. 7
D. 9

12 The following adjacency matrix describes the communication network between five soldiers: Alpha (A), Bravo (B), Charlie (C), Delta (D) and Echo (E). In this network, the vertices of two soldiers are adjacent if the corresponding soldiers have direct communication with each other, and are not adjacent otherwise.

	A	B	C	D	E
A	-	0	-	-	1
B	-	-	1	-	0
C	0	-	-	0	-
D	1	0	-	-	0
E	-	0	1	-	-

Commander Foxtrot decides to choose one of these five soldiers to be her main point of contact, and only considers the closeness centrality measure of this network. Which of the following soldiers is the most appropriate choice?

A. Alpha
B. Bravo
C. Delta
D. Echo

13 A class has 45 students. A network is drawn with 45 vertices, each representing a student in the class. In this network, the vertices of two students are adjacent if the corresponding students are friends, and are not adjacent otherwise. It is known that Alex, Bart and Charles are friends with each other. It is also known that Debbie and Eric are not friends with each other, but are both friends with Alex.

Which one of the following statements must be true about the betweeness centrality measure of Alex?

A. Bcen (Alex) = 0
B. 0 < Bcen (Alex) < 1
C. Bcen (Alex) = 1
D. None of the above

14 An animal shelter has 45 puppies. A network is drawn with 45 vertices, each representing a puppy in the shelter. In this network, the vertices of two puppies are adjacent if the corresponding puppies are friends, and are not adjacent otherwise. It is known that Max has a unique social circle, such that for any two puppies in the shelter excluding Max (e.g., Bella and Charlie), the following equation must be true:

$$d(\text{Bella},\text{Charlie}) = d(\text{Bella},\text{Max}) + d(\text{Max},\text{Charlie})$$

Which one of the following statements must be true about the betweeness centrality measure of Max?

A. Bcen (Max) = 0
B. 0 < Bcen (Max) < 1
C. Bcen (Max) = 1
D. None of the above

15 Moving from the current year to the following year, the size of the Age 0 cohort of the following year is calculated based on the data of the current year. Assume that the Age 0 cohort of the following year arises from (a) the live births in the current year, and that (b) there is no migration at Age 0.

In addition, the following two pieces of information are provided:
1. The total number of births in the current year is 6000, and
2. The sex ratio at birth is 1050.

What is the Age 0 female population of the following year?

A. 2927
B. 3073
C. 3150
D. 6300

16 Moving from the current year to the following year, the size of the Age X cohort* of the following year is calculated based on the data of the current year. Assume that the Age X cohort of the following year arises from (a) the Age X-1 cohort in the current year, minus (b) the Age X-1 deaths in the current year, and plus (c) the Age X migrants.
* X is between 1 and 84 inclusive

In addition, the following three pieces of information are provided:
1. The Age X-1 cohort of the current year comprises 8000 individuals,
2. The Age X-1 death rate of the current year is 25, and
3. The Age X migration rate is 45.

What is the Age X population of the following year?

A. 7615
B. 7845
C. 8151
D. 8160

17 Moving from the current year to the following year, the size of the Age ≥85 cohort of the following year is calculated based on the data of the current year. Assume that the Age ≥85 cohort of the following year arises from (a) the Age ≥84 cohort in the current year, minus (b) the Age ≥84 deaths, and plus (c) the Age ≥85 migrants.

In addition, the following three pieces of information are provided:
1. The Age 84 and Age ≥85 cohorts of the current year comprise 3000 and 10000 individuals respectively,
2. The Age 84 and Age ≥85 death rates of the current year are 55 and 105 respectively, and
3. The Age 84 and Age ≥85 migration rates of the current year are -2 and -5 respectively.

What is the Age ≥85 population of the following year?

A. 11577
B. 11726
C. 11735
D. 11844

18 In a peculiar town where everyone is above 19 years old and retires at 70 years old, the old age support ratio among males is two, and the old age support ratio among females is one. What are the odds *x* that an individual in this town is above the age of 69 years?

A. $0.50 \leq x \leq 0.67$
B. $0.33 \leq x \leq 0.50$
C. $0.50 \leq x \leq 1.00$
D. $0.67 \leq x \leq 0.75$