Question 1

In a quiz, there are five MCQ questions. Two of them have 3 options each, while the other three questions have 4, 5, 6 options, respectively. Suppose a student picks an option randomly for each question, and that the picks are independent of each other.

The probability that the student gets 0 marks is closest to:

a. 0.01
b. 0.12
c. 0.22
d. 0.77

Explanation: The probability is 2/3 x 2/3 x 3/4 x 4/5 x 5/6 = 0.222.

Question 2

Patrick who lives in Singapore used a home kit test for HIV detection. The label of the kit states that the test is known to be 99.9% effective at finding the correct results. To his surprise, the test result was positive. By checking the ministry of health website, Patrick found out that in every 1000 people who live in Singapore, 2 are HIV positive. What is the chance that Patrick actually is HIV positive?

a. 99.9%
b. 86.7%
c. 76.7 %
d. 66.7%

Explanation: Let's use a contingency table. The sequence of filling the table is given by ❶ to ❾.

	Test positive	Test negative	Row sum
With HIV	❹ 2,000*0.999 = 1,998	❻ 2	❷ 1,000,000*0.002 = 2,000
Without HIV	❼ 998	❺ 998,000*0.999 = 997,002	❸ 998,00
Colum sum	❽ 2,996	❾ 997,004	❶ 1,000,000

From above table:

P (with HIV | Tested Positive) = 1998/2996 * 100% = 66.7%

Question 3

The company G&P sells toiletries online. It has decided to operate in Singapore and needs to come up with an advertising plan. Based on previous experience in an e-commerce platform based in South Korea, 10% of the revenue comes from direct search in the platform which has no cost for G&P, 20% comes from side banners, and 70% from pop-up advertisements.

The cost of advertisements for the Singapore-based e-commerce platform are as follows:

Side banner: 2% of the revenue initiated from the side banners

Pop-up: 3% of the revenue initiated from the pop-up advertisements

G&P should anticipate the average cost of advertisements in Singapore to be

a. 5% of the revenue
b. 2.75% of the revenue
c. 2.5% of the revenue
d. 2.25% of the revenue

Explanation: Based on the South Korea e-commerce platform, the expected expense for advertisement would be:

E = 0.1 * 0 + 0.2 * 2% + 0.7 * 3% = 2.5%

Question 4

Suppose you are playing a game in casino and from the rules of the game you know that the house has a 2% advantage over you on each bet, i.e. the chance of casino winning is 52% and the chance of you winning is 48%. Out of 5 bets, you won once. Your friend believes that the casino cheated by not dealing the cards at random. Being familiar with QR, you decide to do a hypothesis test with 5% level of significance.

a. The null hypothesis is that the casino did not cheat, and we cannot reject the null hypothesis
b. The null hypothesis is that the casino did not cheat, and we can reject the null hypothesis
c. The null hypothesis is that the casino cheated, and we cannot reject the null hypothesis

d. The null hypothesis is that the casino cheated, and we can reject the null hypothesis

Explanation:

The null hypothesis should be: Casino did not cheat. With this assumption, the probability that you would win a bet is 0.48. We shall use this probability to calculate the P-value, which is the sum of probabilities of the observed event and even more extreme events. In this case, more extreme event is to lose all bets:

P-value = 5x0.52x0.52x0.52x0.52x0.48 + 0.52x0.52x0.52x0.52x0.52 = 0.213 > 0.05

Since the P-value is not less than 5%, we cannot reject the null hypothesis at 5% level of significance, and hence your friend's claim is not justified. Does this mean he/she is wrong? Well, we don't know. We simply do not have enough evidence to accept his/her claim.

Question 5

After a Quantitative Reasoning test, the professor announced to the class that, among the 100 students who failed the test, 30 of them did not attend any tutorial class.
Which of the following interpretation is correct?

a. A student who did not attend any tutorial class has a 30% chance of failing the test
b. A student who did not attend any tutorial class has a 70% chance of passing the test
c. A student who attended some tutorial classes has a higher chance of failing the test than a student who did not attend any tutorial class.
d. A student who failed the test has a 70% chance of attended some tutorial classes.

Explanation: What the professor announced can be interpreted as P(did not attend tutorial | failed the test) = 30%.
This is not the same as P(failed the test | did not attend tutorial) = 30% (first option).
Second option says P(passed the test | did not attend tutorial) = 70%, which again cannot be derived from the professor's announcement.
What we can derive is P(attended tutorial | failed the test) = 70% (last option), but this does not give us any information about the value of P(failed the test | attended tutorial) (third option).