SciTech College Quiz Championship

Intra Elimination Round.

Note: This questionnaire carries 70 marks and the answers need to be provided in the space below the question.

Question 1: 10 marks

Decode the following sequence.

01110111011100010001000100001000100010000100010001000111011100100

(Hint: Use the number of digits (65) and prime factorization somewhere!!)

Answer: 0111011101110
0010001000100
0010001000100 The 1s read together to form IIT
0010001000100
0111011100100

Question 2: 3+5 = 8marks

Can you beat the Oracle?

a)Suppose you join the sport of swimming at a health club. Now the club has tow payment plans: Rs. 400 for a yearly membership or Rs. 20 for each one time use of the swimming pool. You would love to swim several times in a week but you are prone to muscle pull and injury and know that you won't be able to swim any more once you get hurt. An oracle however can predict when you will get injured and thus determine whether it would be more cost-effective to buy the yearly membership or pay for each use of the pool. You are not clairvoyant, however, so you wish to devise a strategy for minimizing your 'regret ratio', that is the amount you spend divided by amount the oracle would have spent.

If you decide to buy a yearly membership right from the start and then get injured on the first day in the pool; your regret ratio would be 20, i.e. Rs. 400 divided by 20 (the oracle would have spent). If you decide to pay for each use for an entire year and go on to swim 100 times and then get injured your regret ratio would be 5 – the Rs. 2000 you spent divided by the Rs. 400 the oracle would have spent.. Is there a way to keep your regret ratio below 2 no matter when you get hurt?

b)Now, say you have 90 tickets that you can trade for cash. There is a ticket exchange booth in which a man has a pile of Re. 1 and Rs. 5 bills. When you approach the booth, the man inside will offer the bill at the top of the pile – either Re. 1 or Rs. 5 for each of the tickets. You have the option of rejecting Re. 1 offer in the hope that the man will later proffer Rs.5 for the ticket. If you do so, you keep the ticket and the man puts the Re. 1 bill aside, never to be seen again. But the man has the right to halt the trading at any time and after that point the tickets are worth nothing.

An oracle would now in advance who the man will offer and when the exchange will end but you don't. Can you find a strategy that will guarantee a regret ratio (in this case, the oracle's winnings divided by your winnings) that is no more than a 1.8? And what would be your strategy if the two possible offers are Re. 1 and Rs. 1 million. Does the regret ratio improve or worsen?

*Answer: a)*Pay for each use 19 times, the buy a yearly membership. If you injure yourself during the first 19 outings, your regret ratio will be 1.If you injure yourself afterwards, your regret ratio will be 1.95

*Answer: b)*When the possible offers are Re.1 and Rs.5, the best strategy is to take the first 50 offers no matter what and then take only the Rs.5 offers. If the ticket exchange offers Re.1 for each ticket and then halts the trading, your regret ratio will be 1.8(Rs.90 divided by Rs.50). If the exchanger initially offers Re.1 and then switches to Rs.5, the regret ratio is still 1.8(Rs.450 divided by Rs.250). If the possible offers are Re.1 and Rs.1 million, take the first 45 offers no matter what and then wait for Rs.1 million offers. The strategy yields a regret ratio of 2.

Question 3: 10 marks

A mathematically inclined judge uses a unique form of arbitration to settle monetary disputes. As in most arbitrations, the plaintiff and defendant present their evidence to the judge but before the plaintiff begins, he writes down on a piece of paper how much money he thinks he should get- let us call the amount P – and puts the paper in a sealed envelope. Then the defendant writes down how much she is willing to pay – call it D – and puts that number in a separate envelope.

The judge does not know P or D. Once the plaintiff and defendants have presented their evidence, the judge determines an equitable monetary award called J. But in this form of arbitration, the amount actually paid to the plaintiff is determined by comparing. J with P and D. If J is closer to P; the defendant pays P, if J is closer to D; the defendant pays D. For example, say the plaintiff thinks he deserves Rs. 1.8 crore, the defendant thinks she should pay nothing and the judge decides the complaint is worth Rs. 0.8 crores because Rs. 0.8 crore is closer to zero than to Rs. 1.8 crore, the plaintiff gets nothing.

Your challenge is to find the best strategy for the plaintiff. Suppose the judge hints that his award will be between Rs. 0.3 crore and Rs. 1 crore, with all numbers in that range having the same probability of being chosen. How much money should the plaintiff request to maximize his expected compensation?

And should he change his request if he suspects that the defendant will be able to read the number P through the sealed envelope?

*Answer:*The plaintiff will maximize his monetary award by asking for Rs.1 crore, the high end of the judge's range, even if he suspects that the defendant can sneak a peek at his request.

Question 4: 2 marks

Who is he and what relates him to one of the largest rivers in the world?

Answer: Jeff Bezos
Founder of Amazon.com

Question 5: 2 marks

Certain crystalline materials which occur in liqud smectic, nematic and cholesteric phases are used to make an integral part of most watches, calculators and numerous other gadgets. Identify the part manufactured using these crystals.

Answer: Liquid Crystal Display

Question 6: 2 marks

Compact Discs, according to orignal CD specifications and standards held 74 minutes of recorded sound? Why 74 minutes and not a round figure like 50, 75 or 100 minutes?

Answer: This was because it could then contain all of Beethoven's ninth symphony on them.

Question 7: 2 marks

What is the claim to fame of Dr. Paul Zoll ?

Answer: Invented pacemaker in 1952

Question 8: 2 marks

What links the Albany plan of Union of 1754 (related to American political history) and the Bi-Focal lens?

Answer: Benjamin Franklin, inventor of Bifocal lens and laid down Albany Plan.

Question 9: 2 marks

How do we better know the *Flashmatic* invented by Eugene Polly in 1955?

Answer: Remote Control

Question 10: 2 marks

Identify both the people in the photograph.

Answer: Hewlett Packard

Question 11: 3 marks

Identify both the people and link them:

Answer: M.S. Swaminathan + Normal Borlang
Green revolution

Question 12: 2 marks

Which diagnostic test involves injecting a radiopaque contrast medium into a joint and taking an X-Ray?

Answer: Angiography

Question 13: 2 marks

Which disease is caused by this harmful parasite, or in other words identify the disease the person in the icture is suffering from? (Hint: This illness is on the verge of being the second disease after small pox to be eradicated)

Answer: Guinea Worm

Question 14: 2 marks

Which *scale* is traditionally used to measure wind speed?

Answer: Beaufort Scale

Question 15: 2 marks

What do Pleura and Cranium repectively protect?

Answer: Lungs, Brain

Question 16: 2 marks

This might sound weird but I want to know what is the actual colour of the 'black-box' which is fitted into aircrafts?

Answer: Orange

Question 17: 1 mark

In which common household appliance are Klystron tubes used?

Answer: Microwave Oven

Question 18: 1 mark

The name of which scientist is missing in the following sequence:
Lyman, _____, Paschen, Brackett, Pfund ?

Answer: Balmer

Question 19: 1 mark

Which gland in the human body is referred to as the 'master gland' ?

Answer: Pituitary

Question 20: 2 marks

What is the connection between the painting on the left and the picture on the right?

Answer: Andromeda rescued by Perseus, princess of Euthopia in Greek Mythology.
Andromeda Galaxy

Question 21: 5 marks

The resort was too charming a place for such a senseless, smelly crime. Seven rustic bungalows, four of them on a lagoon (A,B,C,D); two on the ocean-front (F,G) and one in the middle (E) , were connected by pathways as shown in the map below. A fisherman saw a sinister looking man carrying a large basket approach the resort from the lagoon and sneak into one of the bungalows bordering that that boy of water. The man then stalked along the pathways from one bungalow to the next, leaving rotting fish everywhere.

Police detectives determined from a set of muddy footprints that the vandal had traveled a long each pathway exactly once. The detectives saw no footprints leading away from the resort (the collective group of bungalows), so they concluded that the fishy character was still hiding in one of the bungalows. Unfortunately, the footprints on the pathways were so indistinct that the detectives could not tell the direction in which they pointed. What is more, the fisherman could not remember which of the four bungalows on the lagoon the criminal had first entered. The police were therefore unable to retrace the fiend's route- all they knew was that he had never walked the same path twice.

You assignment is to find the one bungalow in which the fish vandal must be hiding.

Answer: G

Question 22: 5 marks

Consider the snooker-table setup as shown with the given coordinate system (origin at the southwest pocket) to identify positions. Now the white ball at (2,0) has to be hit so as to reach the pocket at (0,0). However, the ball at (½,0) is blocking a direct shot to the pocket. So give one possible direction of hitting the ball such that: a) the ball strikes the table walls exactly once and b)the ball strikes the table walls exactly twice. (Assume that the angle of reflection is equal to the angle of reflection).

Answer: a) (1,1)

Answer: b) (3,1/2) and (2,1)