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Techn🦉thlon

the international school championship

.....Inspiring Young minds!

Event Partner

J&K Bank
Serving to Empower

JUNIOR SQUAD

Team Details

Name of the participants

Time: **2hrs 30min**
Maximum marks: **116**
Minimum marks: **-29**

1. _____

2. _____

Roll No.: _____

School Name: _____

INSTRUCTIONS

(Please read this section carefully)

General Instructions

1. Fill the Team Details in the space provided, before starting to attempt the paper.
2. Verify that the question paper contains 24 pages and 22 Questions.
3. All the answers must be marked in the OMR provided separately which has to be submitted at the end of 2hr 30 min from the start of examination.
4. The question paper can be taken back home.
5. All answers must be clear and legible. In case of any ambiguity, the decision of evaluator is final.
6. No queries regarding the correctness of the questions shall be entertained.
7. Blank papers, clipboards, log tables, slide rulers, calculators, cellular phones, pagers and any other electronic gadgets are not allowed.
8. No additional sheets will be provided for rough work.

Selection Criteria and Result

1. The ranking will be based on the total marks obtained in all the sections.
2. The result will be declared on or before August 10, 2016 on our website technothlon.techniche.org
   To check your result, login with roll number and password provided in your admit card.
3. The top 50 teams will be invited to IIT Guwahati for the Mains and will be awarded Gold certificates. The next 200 will be awarded Silver certificates.

OMR Instructions

1. DO NOT TAMPER WITH THE OMR.
2. Darken the bubbles properly with BLACK ball point pen only.
3. Fill all the details in the OMR sheet properly.
4. Follow the correct method as shown in the figure to fill in the OMR Sheet.

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MARKING SCHEME

(Please read this section carefully)

Climb and fall scheme :
This scheme consists of 4 types of marking schemes. You start with the type 1 marking scheme. As and when you answer the question correctly, you automatically move on to the type 2 marking scheme and so on. However, if you break the sequence and attempt the question wrongly, you again start from the type 1 sequence and move henceforth. If you skip a question, then you continue from same type.

> *Type 1: (+3 , 0)*
> *Type 2: (+4 ,-1)*
> *Type 3: (+5 ,-2)*
> *Type 4: (+6 ,-3)*

Full or Nil :
Unless and until you answer all the questions of the section correctly, you cannot score in that section i.e., if you solve all questions in a section correctly then, you will be getting Maximum marks which is shown on top of the section. Otherwise, you get zero.

Lazy Caterer's Sequence :
It describes the maximum number of pieces of a circle that can be made with a given number of straight cuts.
  For example, three cuts across a pancake will produce six pieces if the cuts all meet at a common point inside the circle, but up to seven if they do not.
Let the nth term in the sequence be X_n. $X_n = (n^2 + n +2)/2$ for $n > 0$ and $X_0 = 0$.
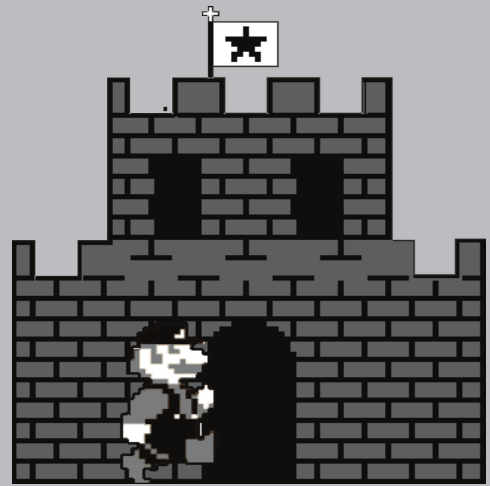*In a section, if you solve n questions correctly and m questions incorrect , then marks you get $= X_{2n} - X_m$*

Boomerang scheme:
If a question is solved correctly , you will be awarded 3 marks. If you do not attempt it, then Zero, otherwise, if attempted wrong , then -3.
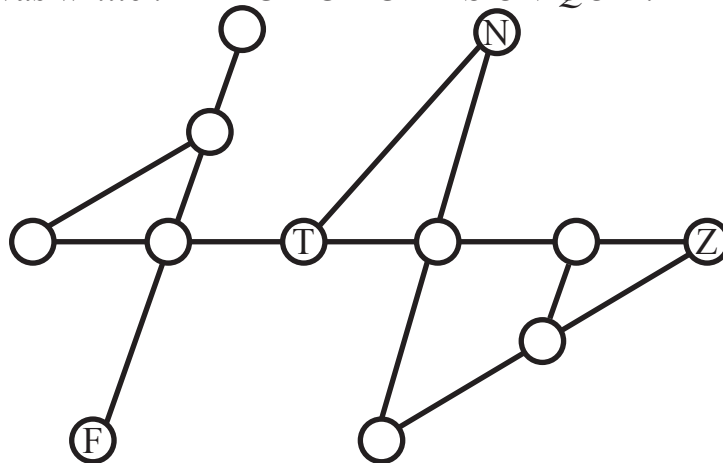
ENTRANCE TO THE CASTLE.

Marking Scheme : Full or Nil with maximum of 7

Mario faces a door with a huge lock in front of him, requiring him to fill various alphabets in the different-looking lock as shown below.

Just above the lock was written - 'EACH CIRCLE IS UNIQUE'.

He finds six plates buried below that door- five of them read 'FROZEN', 'DENTIST', LISTED', 'TORS'and 'FASTEN'. But the sixth one was damaged.

Mario saw that joint lines as given in the figure meant trails of the words on the plates. For eg-1, the trail of 'SWORDS' will be a set of continuous lines joining S-W-O-R-D--S.(W may not be Immediate next to S but they have to be in the same line)

Eg-2 : In the problem figure T,Z can be consequitive letters of word in plates as they are in same line; but N,Z are not in same line, so they cannot be consecutive . He has to fill all the letters correctly in order to open the lock to the castle.
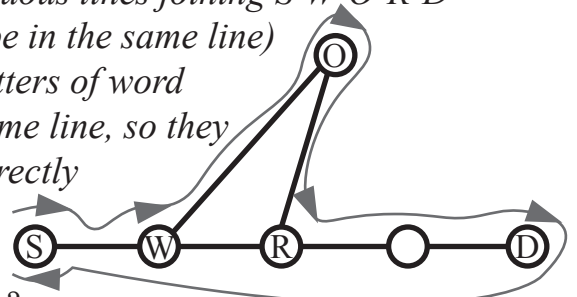
Question 1 :

Which of the following words could be written on the plate ?

    (a) TOASTED   (b) FRIEND   (c) AROSE   (d) TARZAN
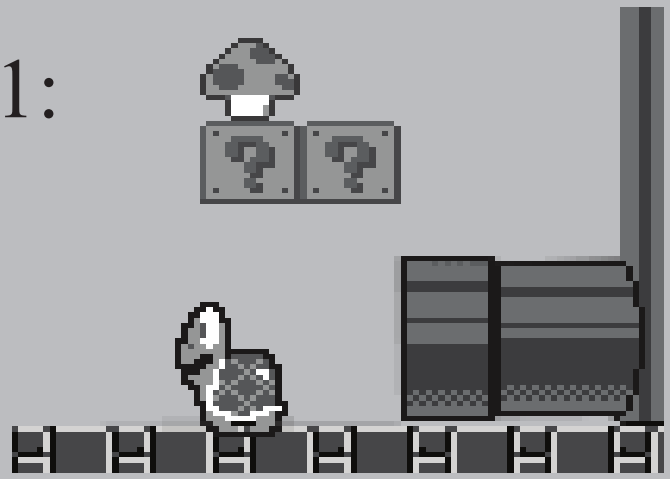
Question 2 :

From the word MONSTER, how many letters are there in horizontal line containing 'Z' ?

    (a) 1   (b) 2   (c) 3   (d) 4

CASTLE LEVEL 1: WATCHMAN'S PATIENCE

Marking Scheme : Lazy Caterer's Sequence

After unlocking the door and entering, Mario met Mr. Quacky Turtle, the wise watchman of the castle and started moving towards him.

Question 3 :

Quacky found a paper in which product of two non-zero digits(1 to 8) is given. Similarly, Mario got sum of the same two numbers and then they are having a conversation.

1. Quacky says "I don't know the numbers".
   Mario says "I don't know the numbers".
2. Quacky says "I don't know the numbers".
   Mario says "I don't know the numbers".
3. Quacky says "I don't know the numbers".
   Mario says "I know the numbers".

What is the product of the numbers ?

    (a) 6   (b) 8   (c) 12   (d) 16

Question 4 :

Impressed by Mario's answer, Quacky drags him into a chamber for a challenge. Chamber has two cells, A and B, with m dogs in one cell and n dogs in another. He also has a magical Dog Killer, which allows him to kill any number of dogs from any one of the cells or kill equal number of dogs from both the cells. For example, he can kill 4 dogs from A or 7 dogs from B or 3 dogs from both A and B. For winning the challenge, Mario must be the one killing the last dog. However, he realises that Quacky also has the same magical Dog Killer, and would take turns with him in order to try and get him killed. Quacky asks Mario to do the first move. How many dogs should Mario kill in his first move if cell A houses 12 dogs and B 15 dogs so that he can survive?

    (a) 10   (b) 14   (c) 16   (d) 12

THE SMELLY TUNNEL

Marking Scheme : Full or Nil with maximum of 8

Question 5 :

To escape Quacky Turtle, Mario used a tunnel which was full of dirty water. To go out, he realized he had to drain all the water away, and immediately, he noticed that the valve box was locked by the lock shown below.15 plates numbered 1 to 15 were kept in the nearby rack, with the instruction, "The distance from plate numbered 1 to plate numbered 2 will be less than the distance from plate numbered 2 to plate numbered 3, which is less than the distance from 3 to 4, and so on". Placing the plates on the unshaded circles, satisfying the conditions on board, find out the value of $a+b$ (where a and b are the numbers to be filled in the indicated circles).
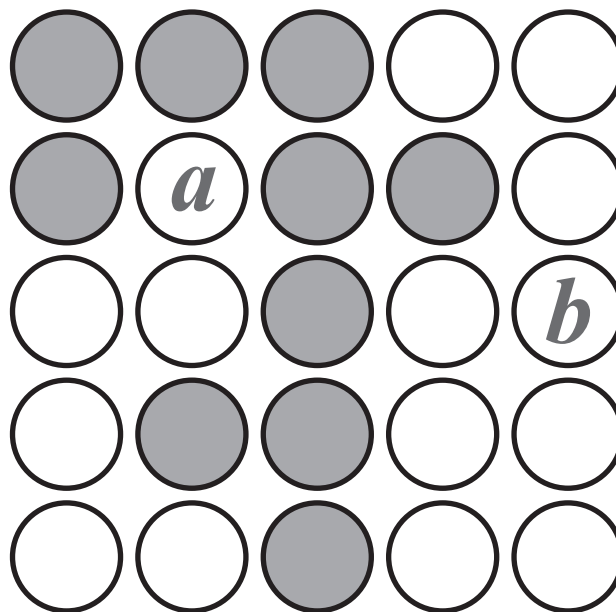
Note : Here Distance is calculated from centre of One Circle to centre to another Circle

(a)10 (b)12

(c)14 (d)16

CASTLE LEVEL 2 : DONKEY KONG'S CHALLENGE

Marking Scheme : Lazy Caterer's Sequence

Somehow Mario gets out of the tunnel and then finds himself face-to-face with the evil gorilla Donkey Kong. Looking down, he saw that he was standing on a gigantic chess-board. He could see various chessmen standing along the board. Donkey Kong shouted, "Domination, total domination! Three challenges, and I want domination in them all!"

Valid moves of Knight

Valid moves of Queen
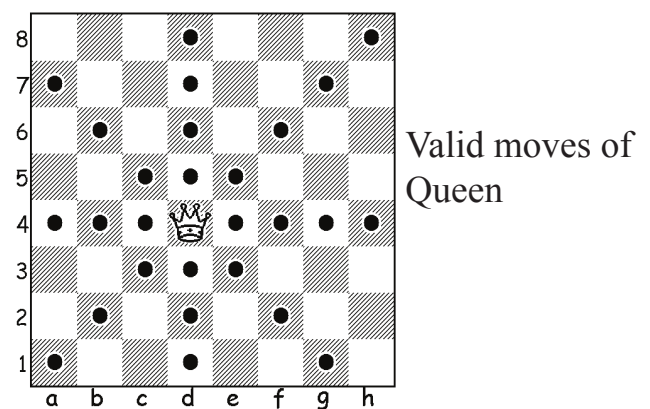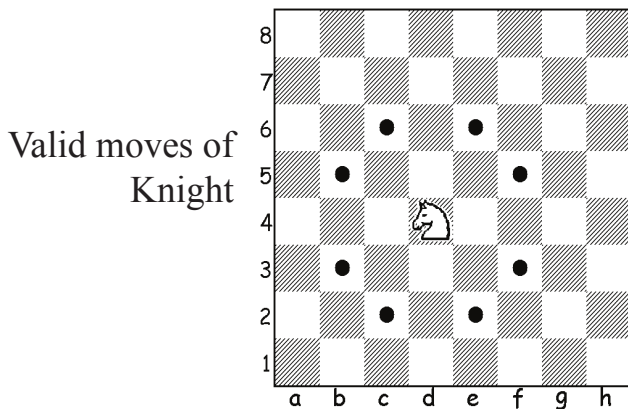
Hint : In chess, domination problems mean arranging a minimum number of a specific type of chess piece such that all places on the board are attacked by atleast one peice.

Total Domination: This is the same as domination but the spaces occupied by the attacking pieces should also be attacked by some other piece.

Question 6 :

What are the minimum number of moves knights have to make on the given 8*6 chess board so that in their final position, they dominate the entire chessboard if the initial position is as given in the figure beside?

(a)8   (b)10   (c)12   (d)None of these
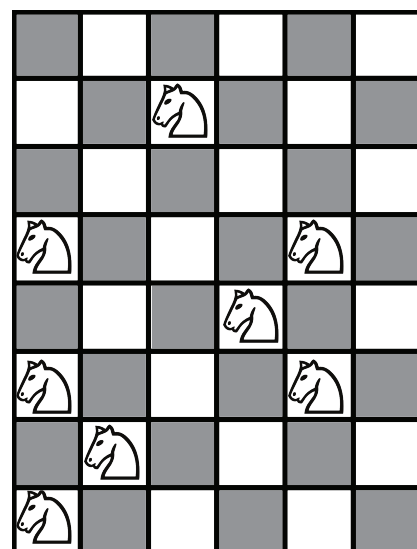
Initial positions of the knights

Question 7 :
How many ways can you arrange 4 queens such that they will dominate a 5*9 chess board?

    (a)4
    (b)2
    (c)6
    (d)None of these

Question 8 :
A 8x8 chess board is in the shape of a torus, where the chess board is on the outer surface of the torus(as shown below). How many minimum number of Knights are required to totally dominate it?

    (a)8
    (b)10
    (c)12
    (d)None of these

INTERCEPTING THE CODE

Marking Scheme : Full or Nil with maximum of 5

Question 9 :

After beating Donkey Kong, Mario was informed by his friend Toad the Mushroom Guy that Bowser, the evil dragon who has kidnapped Princess Peach, uses a different language to communicate which is based on the English alphabets in matrices, and that the princess was not in the castle he was in! So, he decided to use the warp tunnel and left for the same. On reaching the warp zone, he saw the below pattern on the tunnel and realized that Bowser had put it there to prevent him from entering the warp zone. Figure the one important word which the sentence implied by this pattern on the Warp tunnel says to help Mario get out of the castle through the warp.

Noticing his dilemma, Toad hinted that it is very well versed with the word.
eodC dorW +*-!

			+			*								-			!			
					!									*						
			-			*							!							
	!	-	+							*										
		+								*		-				!				

Write down the 2nd letter of the word.

(a)S
(b)H
(c)I
(d)V

OUT IN THE AIR!

Marking Scheme :
*   Climb and Fall*
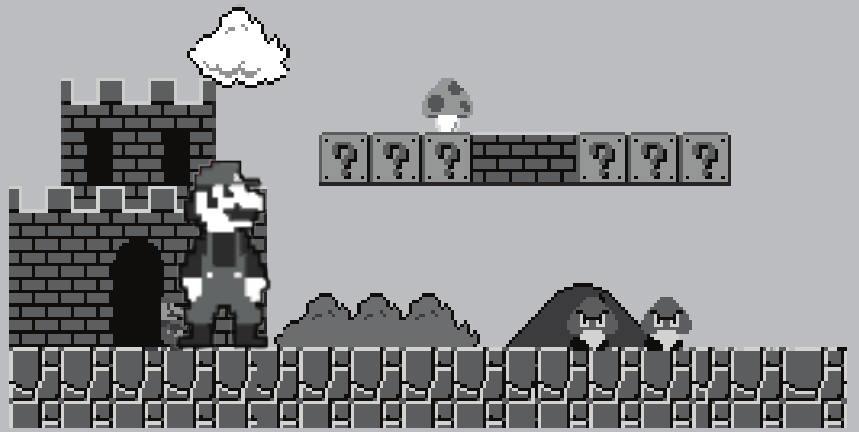
* Answers of following 4 questions are Integers(Double Digit).You need to bubble the numbers in the OMR .For eg : Bubble 08 if the answer is 8 and 49 is the answer is 49

Question 10 :

After somehow escaping from the previous castle, pangs of hunger grip him. Mario visits a chocolate store nearby where the shopkeeper has 9 jars filled with 4,2,6,7,3,4,5,8,3 jellyfishes respectively. Each second he is allowed to either double the content of one jar, or eat 9 jellyfishes (one from each jar).

Can Mario always empty all the jars using these moves?If yes, then give the minimum time required to empty the jars ?
(Answer 0 if no)

Question 11 :

He then enters a mushroom market. In the market, whenever two people greet each other, they have to swap their mushrooms. There are 64 people present in the Market.In order to save time, each pair of people is only allowed to greet each other atmost once. After a lot of greetings, Mario notices that it is no longer possible to return all mushrooms to their respective owners through more greetings. To sensibly resolve this maddening confusion, he decides to bring in even more people (with more mushrooms), to allow for even more greetings and mushroom swappings. How many extra people are needed to return all mushrooms (including the extra ones) to their rightful owners?

Assume a person has exactly one mushroom.

Question 12 :

Further ahead in the market, Mario finds a huge bag containing 171 mushrooms. He reads the label - "Weighing from 1 to 171 kgs, all varieties within". Mario is puzzled as he does not know which mushrooms weighs what. He goes to a stone seller who had an offer of "Buy 1, Get 2 Identical Stones Free". Mario asks him for the different kinds of stones and tells that he can use these to measure any of the mushroom accurately(using common balance). How many different kinds of stones does he buy? (Minimum)

Question 13 :

As he reaches the exit of the market, Mario notices five people who are gathered for an eat-as-much-as-you-can competition. There is a clear order in their hunger (i.e. no two people are identically hungry) and the person who was more hungry initially (at the beginning of the competition) wins in a face-off. How many face-offs are required to rank everyone according to their initial hunger?
Note : Face-offs should be sufficient to guarentee rank of everyone in any case

UNDERWATER?

Marking Scheme : Boomerang Scheme

After the market, Mario reaches the sea coast. Seeing this is the end of the road, he dives into the sea, unknown to the challenges that wait in his path

Question 14 :
As he swam deeper, Mario bumped into Old Man Octopops, who, like his friend, Mr. Quacky Duck, is very fond of puzzles and weird games.
(i) Firstly, Octopops gives Mario to control three 'squid' pieces, while he himself controls a single 'shark' piece. Initially, all four pieces are placed somewhere along a straight line. They take turns making moves, with Mario going first. Each move, a player is allowed to move one of his pieces a distance of at most one unit along the straight line. Octopops wins if his 'shark' piece can catch one of the 'squid' pieces.
(ii) The same game is now played on a two-dimensional plane instead of a straight line. The rules are the same, except now Mario is given 20 'squid' pieces.
Can Octopops always win? Answer for both the questions.

    (a) yes,no   *(b) yes,yes*
    (c) no,no   *(d) no,yes*

Question 15 :
 Swimming further, he could feel something sucking the water out of the sea. He saw a huge 6ft × 6ft hole dug, which was pulling all the water. He has to fill it with some 2 × 2 square tiles and some 4 × 1 rectangular tiles. After arranging the tiles to cover the lava perfectly without overlap, excess pressure caused one of the tiles to smash. Unfortunately, the only spare tile is of the other shape to the one smashed. Will Mario be able to rear-range the remaining unsmashed tiles to perfectly cover the hole again?
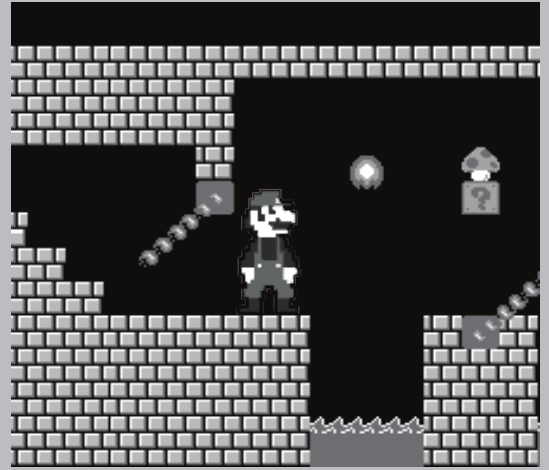
    (a) Yes   *(b) No*
    (c) Yes,Only if broken tile is 4 × 1   *(d) Yes,Only if broken tile is 2 × 2*

BOWSER'S CASTLE FOUND!

Marking Scheme : Lazy Caterer's Sequence

Swimming deeper, a huge sewer comes in the line of sight of Mario. He dives inside it and the sewer closes. Swimming lower and lower, Mario finds himself inside Bowser's Castle, where he can finally rescue Princess Peach. Out of the water, he finds himself staring at a huge door, with the heading 'Bowser Inside'!

Question 16 :
Mario moves on to find a way to get through the main gates of Bowser's chamber. He suddenly finds falling through a trapdoor and lands on something hard. The Devil Ghost Banshee , comes out and says, "This room is a standard 8×8 chessboard. Each of its 64 square is assigned a weight. These weights are assigned in such a manner that weight of a square is an average of the weight of the square that it is surrounded by." Mario now has to determine the weights of all 64 squares and for that Banshee tells him the weights of X squares. What could be the minimum value of X with which Mario can deduce the weights of every other square?

a) 8

b) 32

c) 56

d) None of these

Question 17 :
After crossing the chessboard path successfully, Mario now enters a dungeon where the next clue to get into the main chambers is hidden. In the dungeon, there is a row of 10 rooms and the Devil Ghost Banshee is in one of them. Each day, the ghost moves to an adjacent room. Mario now has to find the creature as soon as possible. But the problem is, Mario can open only one door in a day. What is the minimum no. of days that can guarentee Mario catch the ghost ?

(a) 10

(b) 13

(c) 16

(d) None of these

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THE CLOCK CHAMBER

Question 18 :

After Mario catches the ghost, he questions Banshee of how to enter Bowser's chamber. He stutters and tells him about the password that is hidden in the sacred clock chamber. Inside the clock chamber, he saw 7 weird clocks hanging from the ceiling, and the Banshee said,

"You start reading when,
Begin the night or day then,
Around the clock you read time,
And the secret to out climb"
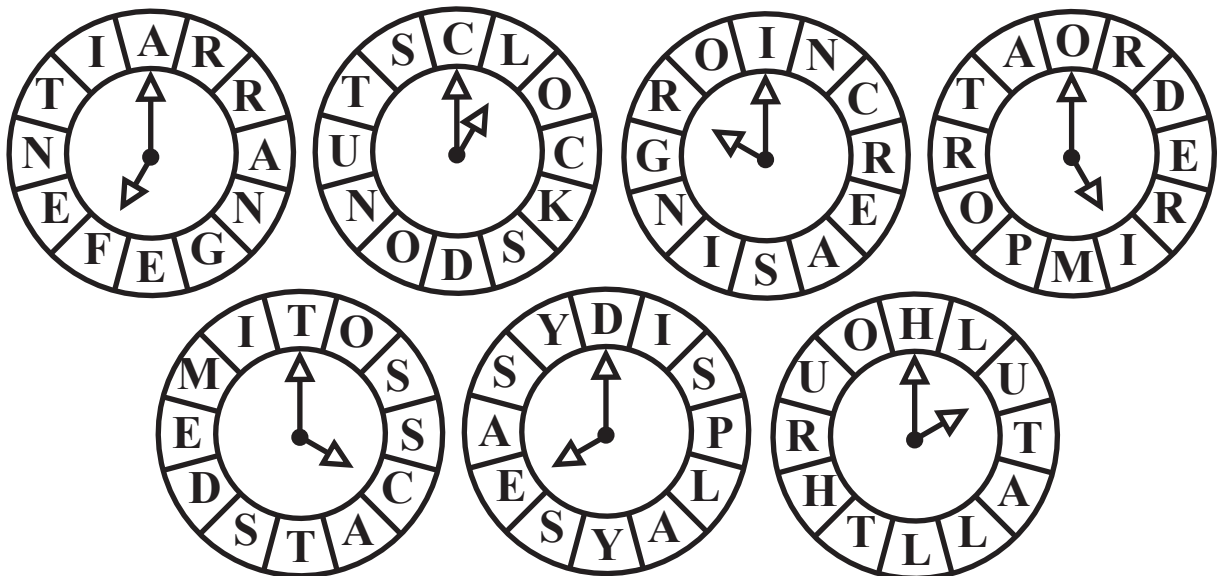
He saw stairs going upwards with a keyboard below them, for typing the password to the castle. What is the password?

(a)ASTERIX   (b)LUCIFER   (c)THUMPER   (d)RAPHAEL

BOWSER'S CHAMBER - LEVEL 1

Marking Scheme : Lazy Caterer's Sequence

Now Mario is at the centre of a circular room, where there are 49 doors around him. Also, he finds a staff, flicking it at a door will toggle 5 consecutive doors, beginning from the door it was flicked at, open doors will be closed while the closed doors will be opened.

Question 19 : Mario's aim is to apply this flickable staff several times to toggle the state of a single door. What are the possible number of times Mario would have to use this staff to achieve his aim?

    (a) 25
    (b) 32
    (c) 40
    (d) 49

Question 20 :
Now suppose, the staff toggles 15 consecutive doors then with how many doors can you acheive his aim of toggling a state of a single door ?

    (a) 53
    (b) 54
    (c) 55
    (d) None of these

BOWSER'S CHAMBER - LEVEL 2

Marking Scheme : Lazy Caterer's Sequence

Mario finally comes face to face with the evil dragon Bowser, who is ready to kill him, but, like all villains, he likes to play games before killing.
So he throws up his favorite L-tromino challenge.

(Hint : An L-tromino is a 2 × 2 tile with one unit square removed)

Question 21 :
He changes the floor into a plate as shown below
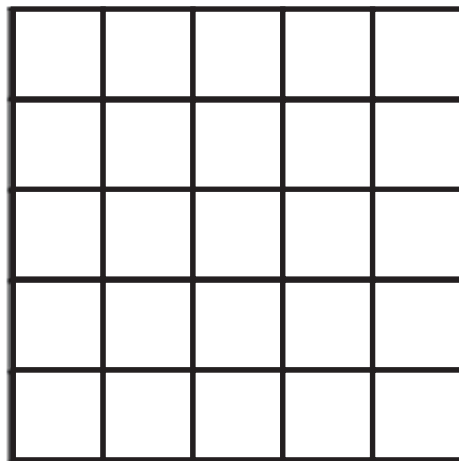
And says his L-Tromino has 3 ground squares and 1 hole.
He says that he has used 8 L-Trominos on the floor and just 1 1x1 single warp tile, which can take him to the next level. However, the problem is that the warp tile looks like the ground tiles, exactly alike.
How many positions could the warp tile possibly be?

    (a)1
    (b)5
    (c)9
    (d)25

Question 22 :
For the final challenge, Bowser asks, "For which integers n, does there exist a shape which can be tiled using 2 × 1 dominoes in exactly n different ways?"

    (a) All Natural Numbers
    (b) n is power of 2
    (c) n is an even number
    (d) n = 2,4

After this Bowser concedes defeat, but tells that Princess Peach is not in his chamber but in IIT Guwahati.

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A word from organizers of Technothlon 2016

Hey!

We hope you had an intriguing two and a half hours racking your brains and scribbling your pens and pencil on the question paper which has been argued as one of the most competitive examinations conducted for the school students in India and abroad. Numerous thoughts might have passed through your mind. While at the other end, when we were deeply engrossed in the process of making the question paper, we too had our thoughts running - "Is the paper too tough? Will the students find it interesting to solve the paper? Are the questions too arbitrary?"

After long thinking and contemplation we realised and this answer came up to us : "Its quite difficult to solve most of this paper in the stipulated time but that isn't our aim. Our aim is that you enjoy solving the paper - whether you solve it in the given time or afterwards. Our intention was to select the best and the brightest minds from across the country, through a paper that would uniformly inspire all young minds. This thirteenth edition of Technothlon prelims comes close to testing the mental prowess that a student requires to become a world leader and in turn inspire as many young minds as he/she can.

*Qualifying the Prelims would surely add as a boost to you and an excitement to look forward in the form of a visit to IIT Guwahati. With a prospect of winning the Ultimate School Champion title and thus a trip to the **AMES Research Centre of NASA in California, USA**, there will be much to aim for and expect laurels.*

However, in case you fail to do so, remember, it is never the end until you decide it to be, and never losing faith is necessary for success in life. As it is said, failures are the pillars to success! We do hope that you will positively take up this challenge, again come back next year and clear one of the most competitive exam.

After the successful conduction of the thirteenth edition of Technothlon, the Chief Organizers would extend their thanks and regards to the city representatives, who braved the scorching heat of the summers and shivering cold of the winters to spread the word of Technothlon in cities across the country. Also our heartfelt thanks to the various organizers and faculty co-ordinators who were instrumental in the smooth conduction off the paper. Last, but not the least, special thanks to the Team Members, who helped us weave a question paper that all participants had fun while solving, I hope.

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An open invitation for a lifelong association with Technothlon

Before you feel like you have reached the end of a sensation, we should remind you that this is merely the beginning! The Technothlon community has been growing at a phenomenal rate, and we invite YOU, the future leaders of the country, to be a part of it. Regardless of whether you make it through to the final round or not, we cherish the opportunity to interact with every one of you. Facebook is our means of reaching out to the student community. Be connected, stay updated!

We are eager to help through counselling of any kind required in any sphere by utilizing the experienced pool of IITians and highly qualified faculty of IIT Guwahati. And finally, we would be glad to receive any constructive feedback about the question-paper or any general issue that you would like to discuss with us. After all, your feedback is what Technothlon thrives on for improvement.

Chief Organizing Team

Dhrubojit Bhattacharya

Amogh Shankar Gupta

Akshay Alikanti

Akshit Ughade

Soumik Mukhopadhyay

A. G. Goutham

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Like a picturesque canvas has the most precise blend of colours, patterns and brush strokes, Techniche year after year promises to be a perfect blend of ideas, innovation and enthrallment. It has stayed true to its vision of motivating the youth of our nation to think out of the box, expand their horizons and reach the zenith of success in all techno-management spheres. Techniche brings forth a kaleidoscope of events, be it the astounding keynotes delivered by globally admired personalities in The Lecture Series or the opportunity to interact with eminent industrialists in The Industrial Conclave. Rediscover your inclination towards the literary aspect of life challenging Literary Events and a chance to perfect your art of diplomacy through IIT Guwahati's Model United Nations. From thrilling Robotic competitions to the enriching Workshops, every bit promises to be a fulfilling experience. With innovative ideas like Technothlon - The International School Championship, The Guwahati Half Marathon as well as other life inspiring initiatives, Techniche has left no stone unturned and now takes pride in being one of the premiere techno-management festivals of the nation.

LECTURE SERIES
The Lecture Series serves as a platform to inspire and motivate thousands of young minds across the world by connecting them with the pioneers in various fields. Students and professors, participants and school children alike, all clamour into the auditorium to interact with illustrious figures from all walks of life who come under one roof and share their experiences and ideas. It brings you an opportunity to interact with such personalities who are at the helm of changing our world today. Previous speakers who have graced the lecture series include the likes of John C. Mather (The 2006 Physics Nobel Laureate), Lyn Evans (Project Leader, Large Hadron Collider, CERN), Pranav Mistry (The Inventor of 6th Sense Technology), Stephen P.Morse (Chief Architect, Intel 8086 Microprocessor), Richard Stallman (Founder, Free Software Movement), Walter Bender (Ex-Director, MIT Media Labs), etc. Having gained immense popularity over the past few years, it is widely recognized as the biggest and the best lecture series in the entire nation.

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INDUSTRIAL CONCLAVE

Industrial Conclave, has been, and forges ahead as an ideal interface between the industry and the students to inspire, motivate and train them for the battle for success in life. In this 3 day long, high profile event, eminent personalities from various spheres share their invaluable experiences which helps the young minds understand the internal dynamics of the ever growing industry.The past editions saw the likes of Mr. Marten Pieters (MD and CEO, Vodafone India), Ms. Vinita Bali (Former CEO and MD, Britannia Industries Ltd), Mr. Arun Iyer (National Creative Director, Lowe Lintas India) among others, the Conclave has ceaselessly grown bigger and better, every year. So, ladies and gentlemen, register now, and witness all the action, here at the Industrial Conclave 2016.

MODEL UNITED NATIONS

Born with the aim to bring out the best in every individual, the concept of IITG MUN is guided by a set of values and goals that seeks to provide every individual "hands down" idea of the intricacies of the decision making process at international level, in an effort to provide holistic development of society as a unit.

ROBOTICS

The Robotics module of Techniche 2016 provides you a platform to bring forth new ideas and produce novel technologies in the quest to build the perfect machine. So, put your thinking caps on and let the creative juices ow. From autonomous to manual robotics, there is going to be something for everybody.

TECH EXPO

Techniche's latest undertaking, the TechExpo has been initiated with the cardinal aim of bringing to light the technological advancements made by the youth of this country and provide an opportunity to showcase their innovations on a larger platform.It provides for a platform for the participants to showcase the projects undertaken by them in front of a mass multitude of people which includes but isn't restricted to Professors from various fields, notable personage including Nobel Laureates and Students from the nation.

And much more....

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