Indian Institute of Technology Guwahati

and

Techniche

The Annual-Techno Managment Festival

30th Aug-2nd Sep

in association with Nimbuzz!

present

Duration: 2hours 30 min Junior Squad Maximum Marks: 163

TEAM DETAILS

Name of Participants:

1. _____

2. _____

Roll Number: _____

School Name: _____

City: _____

State: _____

General Instructions:-

Please read the instructions very carefully before attempting the paper. Failure to do so could cost you dearly.

1. Candidates must fill the Team Details in the space provided, before starting to attempt the paper.
2. All answers must be written in the space provided at the end of this booklet which has to be submitted at the end of the examination. The Question Paper can be taken back home.
3. All answers must be clear and legible. In case of any ambiguity, the decision of evaluation is final.
4. All the questions are correct and no queries will be entertained during the examination.
5. All those teams who have not paid their registration fee must submit it to the invigilators before signing the attendance booklet.
6. No additional sheets will be provided for the rough work.
7. Blank papers, clipboards, log tables, slide rulers, calculators, cellular phones, pagers and any other electronic gadgets are not allowed.
8. This question paper contains pages and **17+13** questions (objective and subjective respectively).
9. The medium for answering this Paper is English. Answers in any other Language will not be accepted.
10. The maximum marks for this paper is **163**.
11. The result will be declared on or before **4th August 2012**.

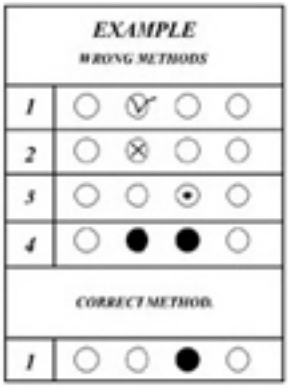
Selection Criteria

Top 1500 teams will be shortlisted on the basis of the objective section marks. Top 250 teams will be selected from these 1500 teams on the basis of their Subjective + Objective section marks. Top 50 among these 250 teams will be invited to IIT Guwahati for Technothlon Mains and will recieve Gold Certificates. The next 200 teams will recieve Silver Certificates.

NOTE: Subjective sections of only the top 1500 teams selected on the basis of Objective section marks will be evaluated.

OMR Instructions

1. Darken the bubbles properly by BLUE/BLACK pen only.
2. OMR sheet should not be FOLDED or SCRATCHED.
3. In case you feel that any is question wrong or short of information then answer it **9999**.
4. Fill all the details given in the OMR sheet properly.
5. Result will be given only on the basis of Hall Ticket number. So, preserve your Hall ticket till the declaration of results.
6. Method to fill in the OMR Sheet.



DISCLAIMER: In any case of any discrepancy, the decision of the Organizers will be deemed final and no further correspondence will be entertained.

Marking Scheme

The following marking schemes will be used for evaluating various questions throughout the paper:

1) PLAIN MARKING SCHEME

This is the standard marking scheme for a section! In the Plain Marking scheme, the total marks you score in a section is a multiple of the number of correct answers you gave in that section.

2) GEOMETRIC MARKING SCHEME

This scheme guarantees bonus marks for more correct answers! In the Geometric Marking scheme, the total marks you score in a section increases exponentially with every correct answer you provide!

3) FIBONACCI MARKING SCHEME

The Fibonacci Marking scheme rewards consistency in answering questions of a section correctly! If 'n' is the number of questions you answered correctly in the section, then your score would be, a multiple of the 'n+1'th term in the Fibonacci Sequence dened by 1,1,2,3,5,8,13...

4) MOMENTUM MARKING SCHEME

In the Momentum marking scheme, a base score of 2 is awarded for a correct answer. For each correct answer in succession, you will be awarded '1+ (the no. of marks awarded for the previous correct answer)'. However, if you break the momentum (by not answering a question, or answering it wrongly), the score awarded to a correct answer resets to 2 (the base score)!
To clarify this scheme, consider this example:
If you correctly answered the rst question, you score 2 marks for it. Also, if you correctly answered the 2nd and 3rd questions, you score 3 and 4 marks, respectively, for the question. Supposing you did not answer the 4th question (or answered it wrongly) - so, you won't be awarded any marks for it. After that, if you answered the 5th question correctly, you will score 2 marks for it, and so on.

5) RIGHT WRONG SCHEME

In thhis Scheme, marks will be awarded according to the following equation:

(c^n - n^c + nc + 1)

where n = Total of no. of incorrect and not complete answers
c = No. of Correct answers

6) TETRAHEDRAL SCHEME

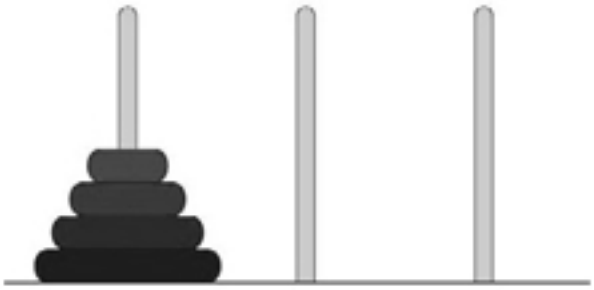
The Tetrahedral Marking scheme rewards consistency in answering questions of a section correctly! The nth tetrahedral number is the sum of the first n triangular numbers. A triangular number is the sum of the first n natural numbers. Marks awarded in this section will be the nth Tetrahedral number where n is the number of correct answers.

7) PASCAL SCHEME

In this scheme base marks are awarded according to Plain Marking Scheme.The Pascal Triangle marking scheme rewards bonus marks as per the Pascal Triangle. A simple construction of the triangle proceeds in the following manner. On row 0, write only the number 1. Then, to construct the elements of following rows, add the number above and to the left with the number above and to the right to find the new value. If either the number to the right or left is not present, substitute a zero in its place.
Look at the Nth line of the Pascal triangle, if the section contains N questions. Call this the 'active line'. If you correctly attempt both the ith and (N-i+1)th questions, add the ith and the (N-i+1)th numbers of the active line. The resulting sum is the number of bonus marks you get.
E.g., If you answer 1st and last question correctly, and the section contains 7 questions (i = 0, N = 7), you get bonus marks equal to the sum of the first and last numbers of the 7th line of the Pascal triangle.

No marks will be awarded for a section with no questions correctly answered.
There is NO negative marking for any section.

Towers Of Hanoi



(Geometric Marking Scheme - 3*2^N
N is the number of correct answers)

There are three pegs, A, B & C, and a number of distinctly sized disks stacked on A, in order of increasing size from top to bottom. In any one move, you can move only one disk either from A to B (or B to A), or B to C (or vice versa) but **not** from A to C or C to A. Also, at no point of time are you allowed to place a disk of a larger size on top of a disk of a smaller size.

Question 1:

What is the least number of moves required to move a stack of 6 disks from peg A to peg C, following these rules?

a) 521 b) 728 c) 983 d) 216
e) None of these

Question 2:

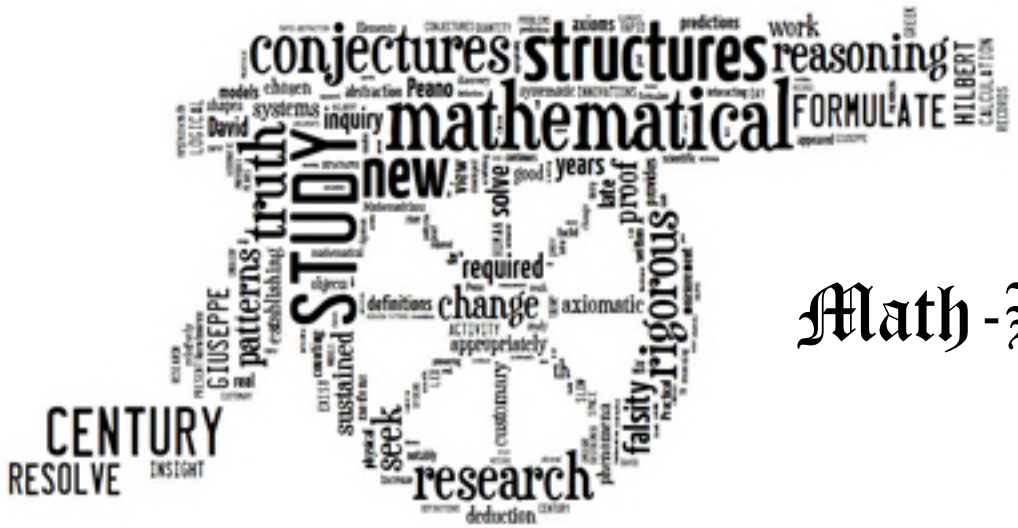
Initially, peg A has disks of sizes 4 and 5, peg B has disk of size 3 and peg C has disks of sizes 1 and 2. What is the minimum number of steps required to move all disks to peg C?

2) 341 b) 436 c) 291 d) 572
e) None of these

Question 3:

Initially, peg A has a stack of 7 disks. In the final configuration, peg A has disks of sizes 6 and 7, peg B has disks of sizes 4 and 5 and peg C has disks of sizes 1,2 and 3. What is the minimum number of moves required to obtain the given final configuration?

a) 243 b) 289 c) 419 d) 134
e) None of these



Math-Battle

(Geometric Marking Scheme - 2*3^N
N is the number of correct answers)

On planet Zlatan, the warlords are having a crisis on their hands. A war has broken out between two rival kingdoms and the ensuing battle is sure to claim millions of lives. However, apart from being fierce warriors, the Zlatans are also excellent mathematicians. Hence, the Warlords decided to invent a little game to decide the outcome of the battle without bloodshed. The game is played with a series of intergalactic rocks. Each rock will have two numbers printed on it, and the rocks will be placed in a sequence. A participant starts at the first rock in the sequence and chooses one number from each rock that he stops at, according to the following rules:

• At rock x, if you pick up the smaller number, you move on to the next rock, x+1, in the sequence.

• At rock x, if you pick up the larger number, you skip the next tile and move to rock x+2 in the sequence.

The game ends when the participants next move takes him beyond the end of the sequence. His score is the sum of all the numbers he has picked up. His goal is to maximise his score.

What is the maximum score that can be achieved from the given combinations of rocks?

Question 4:

In the first round of the competition, there are 4 intergalactic rocks as follows:

Rock 1 - (1,2)
Rock 2 - (1,3)
Rock 3 - (1,-1)
Rock 4 - (-2,-3)

a) 4 b) 5 c) 3 d) 6 e) None of these

Question 5:

In the second round of the competition, there are 5 intergalactic rocks as follows:

Rock 1 - (2,-2)
Rock 2 - (-3,-2)
Rock 3 - (-3,-1)
Rock 4 - (1,2)
Rock 5 - (1,-5)

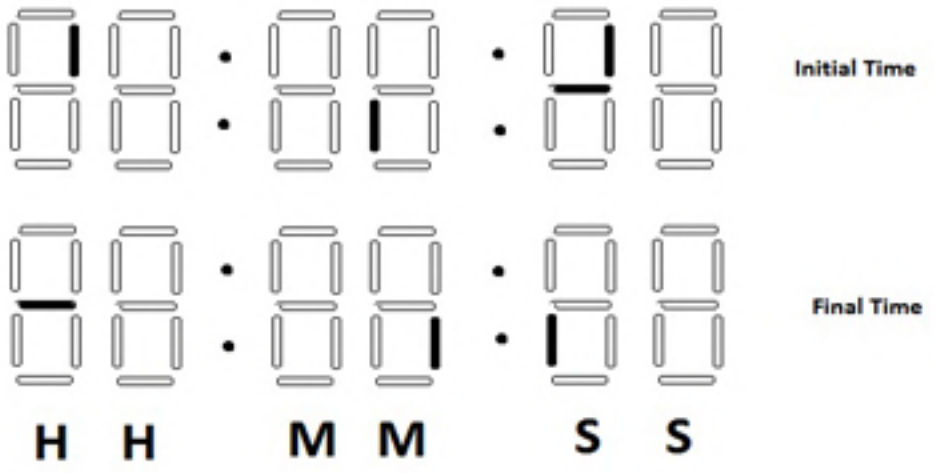
a) 3 b) 2 c) 4 d) 1 e) None of these

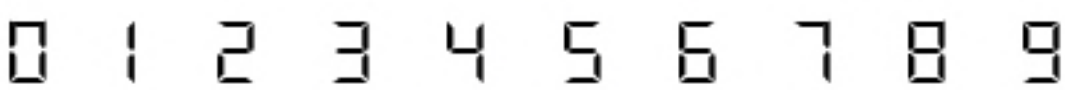
I mix up an owl over a standing Z & a standing Z over an owl

(Tetrahedral Scheme)

Question 6

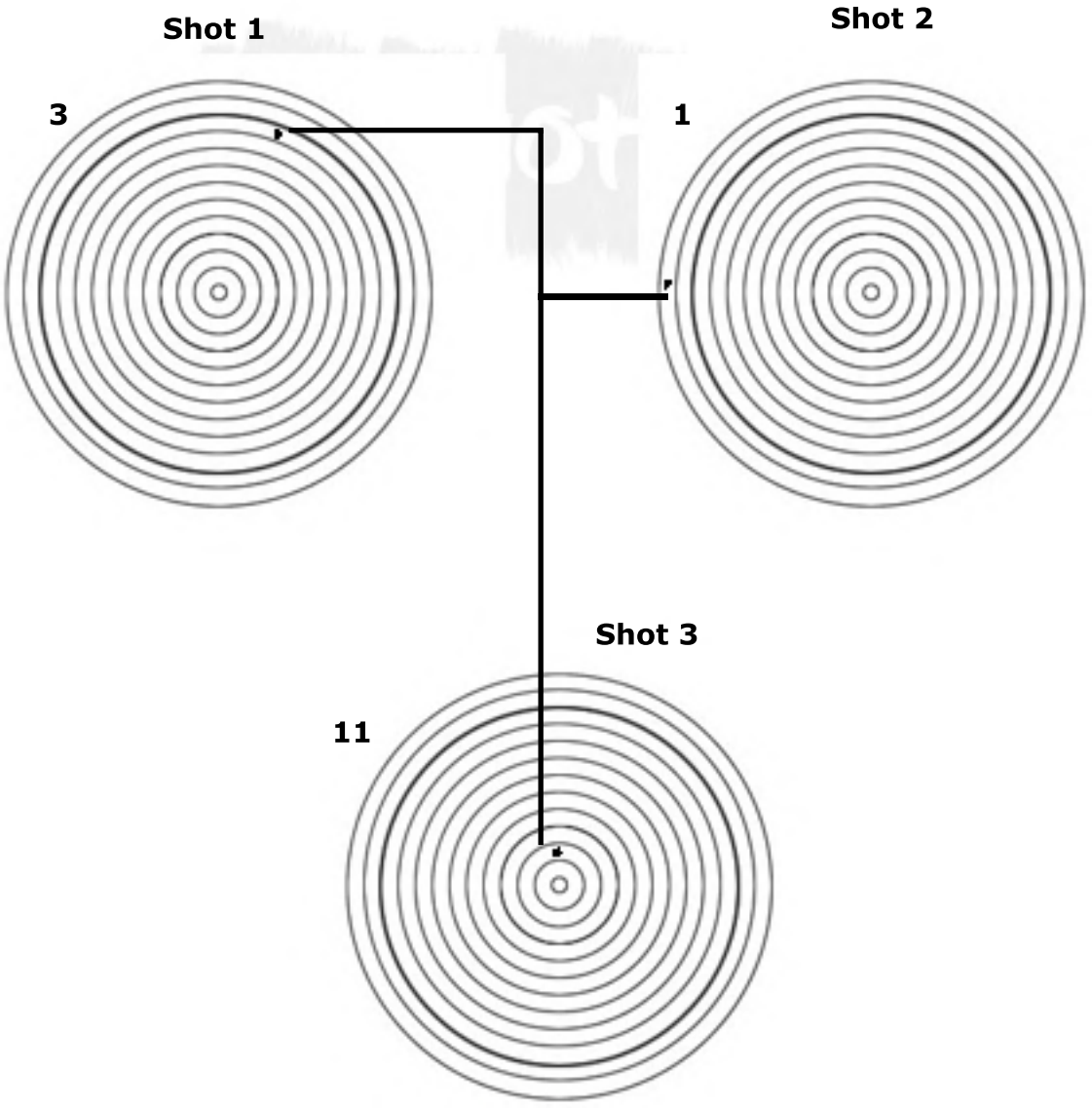
In a puzzle competition, one participant took 131 seconds to solve a puzzle.The time was measured with the help of 24 hour digital clock. But there was a problem in the clock and some parts of numbers in clock were not visible. You have to find out the starting time and ending time with the help of the given photos of the clock.
Note: If your Final time is 01:23:45 then fill in the OMR as 2345.





Bull's -Eye

Question 7:
Once there was an archery competition held in the kingdom of Sparta; which showcased the likes of Achilles, Hector, Ulysses and Helen-us. They were each given 3 arrows to shoot the target with. After a breathtaking round of competition, it was found that all 4 of them had scored equal points. The rules were to shoot the arrows and points were awarded ranging from 1 to 13 based on the distance from the bull's eye. The first 3 shots have been shown here. What are the scores of the other two shots of the person who scored 1 point in one of the shots?
Write the answer in ascending order.
How to answer: If the scores are 13,6 then write your answer as 0613 in the OMR sheet.

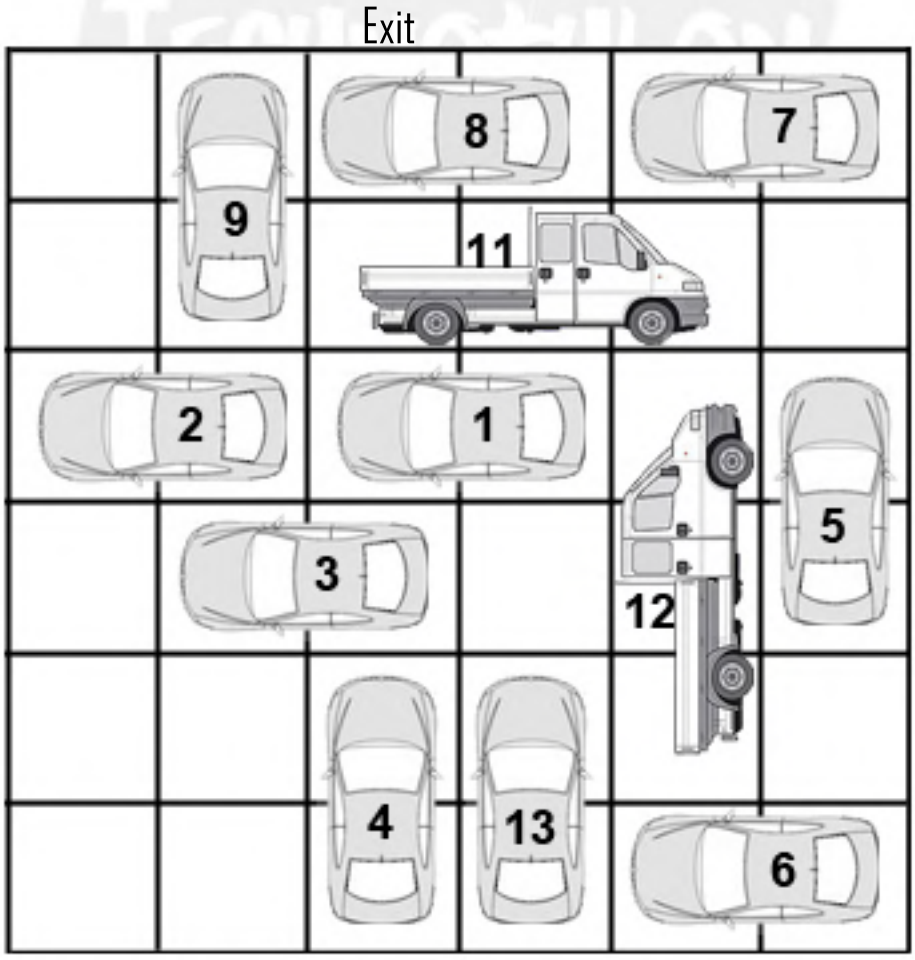


If you join two parts of mine which are in word, at the bases,I can help you to climb up for certain height with good support guess me!

Question 8:

In a parking lot, there is only one gate for the arrival of cars.One day Aniket parked his car in that parking lot. After some time when he returned to his car, he noticed that the parking space was full of cars and that the other cars were parked randomly at any place. Unfortunately, his car was not in front of the exit gate. So, to bring out his car from that space, the man took the keys of all the cars from the guard and arranged them in such a way so as to be able to bring his car to the exit gate. All the cars can move only in the forward and backward directions. The man is able to drive each and every car as many times as he wants. Your task is to find the minimum no. of steps in which his car (car number 4) can leave the parking lot?

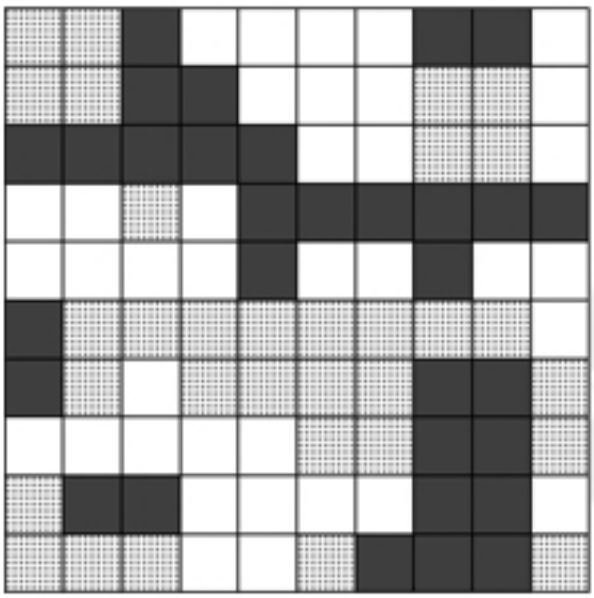
Initial grid of the parking space is given:



Two sets of "three books which are placed horizontally in a rack one above the other"

BOARD GAME

(Plain Marking Scheme - 4*N
N is the number of correct answers)



Let's play a game. It is a vertical board game. Keep in mind that gravity is constantly acting on all the elements of the game. Here we have three blocks of different patterns and they are all explosive, but only when more than one are together. Note that you score based on a simple equation: Score = (No. of blocks exploded at once)^2. Therefore the larger the chain the more is your score. Also as soon as one of the rows is completely empty, the two of the parts created due to this gap close in on each other and fill the gap. For example, if 1,2,3,4,5 are the columns of the game and at some point of time 3rd column is empty, so immediately the two parts created i.e. 1,2 and 4, 5 come together and the new arrangement thus formed is 1,2,4,5. Have fun while playing, but to spice things up you will be asked a few question based completely on your experience of playing this game.

Question 9:

Which type of block fetches you the maximum score with minimum number of moves?

a)White one b)dotted one c)grey one
d)Both a and b e)Data insufficient

Question 10:

What is the minimum number of moves you need to clear one of the above colours?

a)4 b)5 c)6 d)8
e)None of these

If i join with my image i will be nothing. And so placed separately with my image rotated 180 degrees

TOGGLING LIGHTS

Ketan wants to be an actor but his parents do not support his dream. One night he plans to flee and try out his luck in the film city but doesn't want his parents to know his intentions. He wants to switch off all the lights of his house so that no one discovers that he was fleeing. As the bungalow was quite old, the wiring had worn out. If he switched off one of the lights, the adjacent lights' state toggled, but some are faulty (crossed) switches which don't have any effect. He needs your assistance for the same. Please help him out.

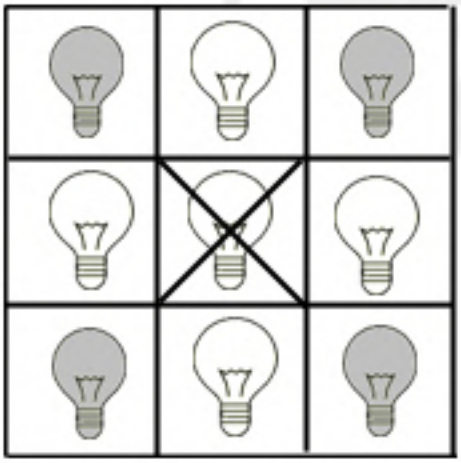
Bulb on

Bulb off

Faulty switch

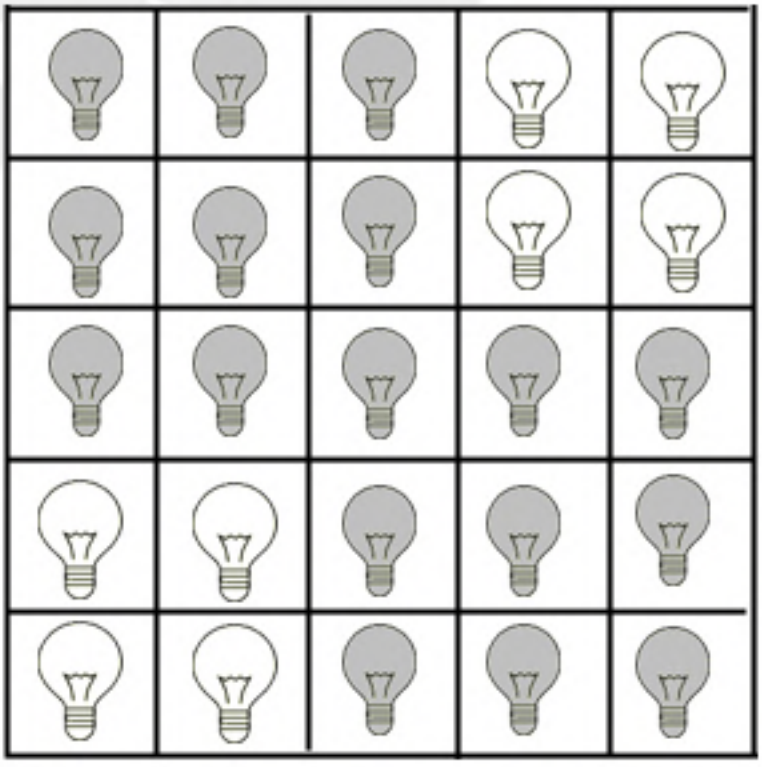
Question11:

What is the minimum no. of steps in which he will be able to switch off all the lights present in his bedroom(the 3x3 grid)?



Question 12:

What is the minimum no. of steps in which he will be able to switch off all the lights in the hall(5x5 grid)?



(Right Wrong Scheme - (c^n - n^c + nc + 1)
--- c is the number of correct answers
--- n is the number of incorrect answers)

Question 13:

A businessman found that there is a lot of oil beneath some land in a remote village. His company quickly surveyed the land and found that some villagers inhabited the land and the houses were organized in a A x B grid, each cell having exactly one house. To acquire all the land, they planned to spread a rumour and let the villagers vacate the land themselves. The company started the rumour at a certain house on day 1. It takes 1 whole day for the rumour to spread from a house to all of its neighbours (top, left, bottom, right). The reaction was quick, i.e. they(the villagers) left the village as soon as they come to know about the rumour. Given that A = 3, B = 7 and that the company chooses the best possible starting point, find the minimum number of days to vacate the village.

Question 14:

Given 6 zeroes and 5 ones on a blackboard, Ram has to cross out pairs of numbers and write a number instead of them. If the pair he chooses is made up of equal numbers, he writes replaces them with a zero. While if they are unequal, he replaces them with a one. He stops only when he is left with a single uncrossed number. Can you help him guess the number which he will end up with?

Question 15:

In a chessboard colouring of the "two-dimensional plane", every black square has an equal number of white and black neighbours - 4 (even touching vertices counts as being neighbours). If one did a chessboard colouring of the 3-D space, such that it (the 3-D space) is divided into cubes, and for the two planes "vertical" and "horizontal" that every cube belongs to, has a chessboard colouring, what is the number of black neighbouring cubes a black cube has?

Two lines touching each other perpendicularly

Question 16:

Prisons, by tradition, are very fond of orderliness. The prisoners, however, are not. One such prison (looked after by the able Jailor Sagar) requires daily parades in a particular order, which is inevitably broken by the prisoners. Since re-arranging them from the scratch was a hectic job, the Jailor came up with an alogrithm. The prisoners were made to stand in a line, and the following procedure repeated: a prisoner was made to move leftwards in the line, until there was no one of higher rank (as defined by the order) on his left. One such day, during the rearrangement, the number of steps taken by each of the prisoners is given below:

Number of steps: 0 1 2 3 1 0 2
Prisoner number: 1 2 3 4 5 6 7

Identify the initial order in which the prisoners were standing.

How to answer: If the initial configuration was 7654321, answer with 4321.

Question 17:

Aditya, the anchor of a Quiz Show wants to keep his crowd engaged when the participants were busy completing the assigned task. He decides brain teasers are the way to take. He tells the audience of two situations, one where the hour hand was exactly at a minute mark on the clock and the minute hand was 6 minutes ahead of it and the other where the hour hand was again on some other minute mark, with the minutes hand was 7 minutes ahead of it. The question is to find out the minimum time difference between the said situations.

Are you smarter than the audience?

Fun-Bytes

(Momentum Marking Scheme)

Question 1

Its riddle time: I am always with you, wherever you go. I keep following you, but as soon as you try to catch me, I run ahead of you. Wherever you stand I'll be behind you, but once you turn around I'll be hiding behind your own back. I tend to grow with your every move. Who am I?

Question 2

The world is full of paradox. Once Omprakash was going for camping where he encountered a fascinating paradox. While at his camp, every day he woke up and started moving towards the north. After moving a distance of 10 miles he stopped for lunch. After finishing his lunch he again started moving North and after completing 10 miles he again reached the place where it all began; his camp. Can you explain this paradox?

Question 3

The story takes us back to the times of Maharaja Vikramaditya. He was possessed by a demon called Betal who once asked him a tricky question to judge his wit. He showed him 3 coins (gold, silver and copper) and told him that if he made a true statement, he'll get a coin; else he won't be getting any of the coins. Imagine yourself to be Vikramaditya and try and make an apt statement which will ensure that you get a gold coin.

Question 4

An officer called up his peon, gave him a list of things, and asked him to bring them to office before he himself arrived. He also told him to take money from an envelope which was under his office table. When the peon took the envelope, he saw 86 written on it. After buying the things the total bill was 90 Rs. The peon used the money from the envelope and found that he was still left with some money. How much money was left with the peon after paying the bill ?

Question 5

Jai is a very negligent guy. He never used to bother about organizing the things in his life; take his room for instance. It symbolized havoc on the face of earth; covered a complete chaos. Bed the place for everything ranging from toothbrush to face wash, from alarm clock to laptop and from his jeans to his books. The place was a total menace but strikingly he always found out whatever he was searching for. It was totally remarkable but leaves a number of his friends including me flummoxed at times. Once he had a seminar to attend to, about which his whole future was circling around. He woke up that morning at 8:34 am, with two candles by his table one of which was 9 cm long and one a bit smaller which was 4 cm long. He just had to leave his room latest by 9:17 am in order to make it to the seminar. He finally made it just in the nick of time but as usual it left me wondering; how he kept the track of time.

Question 6

Neha (Queen 42kg), Preety (Princess 36kg) and Shubham (King 78kg) are stuck at the top of a building. A pulley is fixed there over which there is a rope with a basket on each end. One basket has 30kg marbles. The baskets are enough for 2 or 1 person and the marbles. Taking safety into account if someone is inside one of the baskets, the difference between their weights should not be more than 6kg. How can they all escape?

(Pascal Scheme - 4*N + Bonus
N is the number of correct answers)

Question 7:
Sixteen alphabets are written in a 4x4 square with rows and columns(as a sense o coordinate axis). The word LUMBERJACK is converted into a series of numbers using these co-ordinates, and the number 1 is added at the beginning of this series and the number 4 at the end of this series. This new cipher of twenty-two numbers is broken up into pairs, and reconverted into letter s using the same 4x4 squarethe result is BESOLKHCUAI. Another word is similarly treated, using the same square, but with a 4 added at the beginning and a 1 at the end. This comes out TMOCHRBNSSE. What is the original word for the second cipher?

Question 8:
The Tap Code is a code, commonly used by prisoners in jail to communicate with one another. The method of communicating is usually by "tapping" either the metal bars or the walls inside the cell, hence its name. In this code, a grid is constructed in which the alphabet is written in a 5x5 square, starting horizontally, omitting K.This is called the Polybius Square. Each letter was communicated by tapping two numbers designating the row and column of the letter, not necessarily in that order . The letter "X" was used to break up different words and the letter "K" replaced by the letter "C".
Using this decipher the following message:

. ...
. ...
.. ..
... .
. ...
....
. ...

I'm here with you

Question 9

In a columnar transposition, the message is written out in rows of a fixed length(the spaces between the words is deleted).If the last row is not fully filled then the remaining space is filled with random letters.
The message is then enciphered by reading it column by column, where the columns are chosen in some scrambled order. The number of columns (ie. the length of a row) and the order in which they are chosen is defined by a keyword.
If the word SUNFLOWER is the keyword, there are 9 columns that will be read of in the following order:

784235916

If the enciphered text is :
EVLNE ACDTK ESEAQ ROFOJ DEECU WIREE
Find the order of the columns.

Question 10

One of the modern techniques in cryptography is the ADDITIVE SUBSTITUTION CIPHER .
Although the Greek writer POLYIBIUS described a substitution technique, its first recorded use was by JULIUS CAESAR. Messages were encoded by substituting the letter in the text by one that is three positions to the right. A became D, V became Y etc. The number of places to be shifted is variable in this code but once the number is decided it remains to be consistent throughout the cipher.

Let's see if you can decode this :

"W K H "H V E J M " P F S O Y H W F C I U V "

"_ _ _ "_ A _ _ _ " _ _ _ A _ _ _ _ _ _ _ _ "

*The " indicates spaces between the words

Question 11
Morse-Code is like one of the most recent substitution ciphers. For those all who are interested in knowing what it is look below!
In yester years when Morse code was used in military communications, they used to transmit this in encoded forms (codes inside codes) .well ,what they actually did was that the message was written in the intermediate cipher text by converting each letter into a series of dots and dashes using the above table. to get the final enciphered text, they converted the 9 possible combinations(of two characters each) of the dash, space and dot characters into numbers 1-9 and the series of dots and dashes of the intermediate cipher text were converted into a series of numbers using it.
During the Second World War, a soldier intercepted the code:

412214223112

and with the help from his country's intelligence bureau got further information which is as follows(which is not sufficient to decode the message).
The document he gets from the intelligence says :

"The message contains only one space essentially dividing it into two words of 6 & 3 letters, respectively. Some parts of the first word are B _ _ _ _ C. And the last letter of the second word is A "
Help him decrypt the code!!

The following two questions' hints have been spread all over the paper please read them carefuly and try to find the answers:

12.
Once Surendra's grandfather told him that whenever he wants to do something big, he needs to go beyond the obvious. He left certain hints in his will for him to decipher, so that he could know what is it that defines going beyond the obvious. See whether you can figure it out.

13.
I am something with whom you are highly familiar.

A word from the Organisers of Technothlon 2012

The Question Paper

As our team sat together to prepare the question paper that you attempted during the course of the last two hours, a few thoughts often crossed our minds:

'Is the paper too tough? Will the students be able to enjoy it? Should we make it easier?'

Well, we contemplated long and hard on this, and the answer we came up with was:

The paper has been designed such that you've got to be awesome to solve all of the questions within the stipulated time. We stressed on this fact during our team's meetings. Our intention was to select the best and the brightest minds from across the country, through a paper that would uniformly inspire all youngs minds that wrote it.

The preliminary round of Technothlon 2012, in our opinion, comes close to testing the mental prowess that a student requires to become a world leader. Most definitely, it is wonderful to clear the preliminary round. However - don't be disheartened if you don't manage to clear it!

"Success is not final, and failure is not fatal. It's the courage to continue that counts.", as Winston Churchill famously put it. We hope that you will positively take up the challenge of returning here next year and attempt to clear what is arguably, one of the most competitive examinations conducted for school students in India.

On a side note, you might have noticed that the question paper was peppered with names of various people. We would like to point out that these are the names of members of Team Technothlon who were involved with the preparation of the Question paper. They've spent long hours in building from scratch a question paper that students all over the nation could solve, and as you might probably agree, they have done a pretty good job! We really do hope that you had as good a time solving the questions as we did while preparing them!

Indian Institute of Technology Guwahati

Presenting the body that brought Technothlon 2012 to you – IIT Guwhahati! Established in 1994 as the sixth member of the IIT Fraternity, IIT Guwahati is one of the premier institutions for engineering, science and technology in the country. IIT Guwahati functions completely in a state-of-the-art and generously endowed campus both in infrastructure and natural beauty. Spread across 700 acres with the majestic Brahmaputra on one side, and hillocks and lakes on the other, this campus with its natural beauty provides an ideal setting for learning and innovation. We, as IITians, strive for excellence in all walks of life. Because, excellence and innovation are two words that aptly define the 3000-odd students who live on this campus.

Techniche

Techniche is the annual techno–management festival of IIT Guwahati. Every year, the IIT-G student community organises Techniche which draws an immense participation from around the world. Techniche is conducted with a vision to foster the spirit of science and technology among the youth of India and has successfully completed 12 editions. Eminent personalities, Nobel laureates, and world leaders have graced the stage during Techniche in its past editions. With 'Pixelating Perfection' as the tag line for the coming-up 2012 edition of Techniche, you just know that the techno-management extravaganza is going to get much bigger. Technothlon – The International School Championship is the module of Techniche devoted exclusively to school students across India!

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, Twitter, Wordpress and Flicker are our means of reaching out to the student community - Be connected, stay updated!

We are eager to help through counseling 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 Organising Team

P. Jai Vardhan Rao
Aayushi Bajpayee
Rishikesh Ghewari
Alpana Kumari
Ketan Ganar
Deepanshu Goyal
M.V.S.R. Sastry

Contact us at

www.techniche.org/technothlon/

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Answer Sheet

Instructions:

1. Please Answer only the Subjective Part of the paper in the space provided below.
2. Please fill all the Details provided below carefully with black or blue ball point pen.

Name: 1. _____ Contact No.: 1. _____

2. _____ 2. _____

Email-Id: 1. _____ School: _____

2. _____ Squad: _____

Registration No: _____ City: _____

Fun Bytes

1. _____ 2. _____

3. _____ 4. _____

5. _____

6. _____

Code Crunchers

7. _____

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11. _____

Pixelating Perfection

12. _____ 13. _____