IIT Guwahati

Techniche
The annual Techno-Management Festival
IIT Guwahati | 31st Aug - 3rd Sept 2017

Vedantu
presents

Technothlon
the international school championship
.....Inspiring Young minds!

PAPER THEME
Harry Potter

HAUTS SQUAD

Time: **2hrs 30min**
Maximum marks: 111
Minimum marks: -39

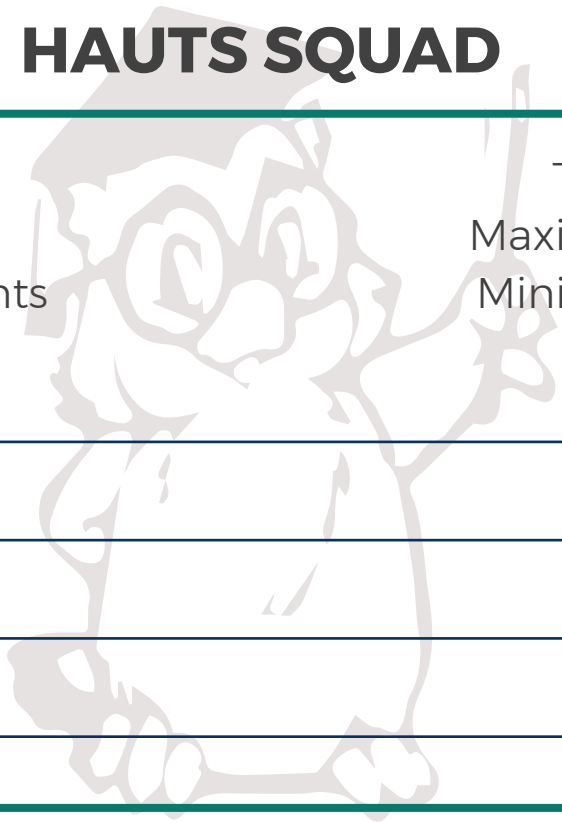
Team Details
Name of the participants

1. _____

2. _____

Roll No.: _____

School Name: _____



INSTRUCTIONS

(Please read this section carefully)

General Instructions

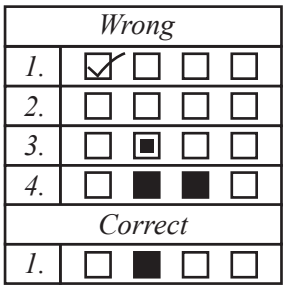
1. *Fill the Team Details in the space provided, before attempting the paper.*
2. *Verify that the question paper contains 32 pages and 20 Questions.*
3. *All the answers must be marked in the OMR sheet provided.*
4. *The question paper can be taken back home.*
5. *No queries regarding the correctness of the questions shall be entertained.*
6. *Blank papers, clip boards, log tables, slide rulers, calculators, cellular phones, pagers and any other electronic gadgets are not allowed.*
7. *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 8, 2017 on our website technothlon.techniche.org. To check your result, login with roll number and pass word 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.*



Instructions for Integer Type Questions

For integer type questions, write the answer in the boxes provided and darken the corresponding boxes. For example, if the answer is 27, shade 2 in the first column, and 7 in the second column. If you get a single digit answer, darken 0 in the first column and your answer in the second column. For example, if the answer is 7, darken 0 in the first column and 7 in the second column.

MARKING SCHEME

(Please read this section carefully)

Power Scheme : *For consecutive correct questions you will be awarded 2, 2^2, 2^3 and so on and for every consecutive incorrect question you will be awarded -2^0, -2^1, -2^2, -2^3 and so on.*

E.g. Solving 5 questions, For all correct they get 2+4+8+16+32 = 62
For all incorrect they get -1-2-4-8-16= -31
For RRWRR they get 2+4-1+2+4= 11
For RRRWR They get 2+4+8-1+2= 15. And so on.

All or Nothing : *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.*

Fibonacci Sequence : *A Fibonacci Series is a series of numbers in which the nth term is the sum of the (n-1)th and (n-2)th terms. The series starts with 1,1,2,3,5… So the next term in the series will be 3+5=8.*
In this marking scheme, your marks start from 2. If you answer consecutive questions correctly, your marks will increase according to the sequence. For example, if you answer 3 consecutive questions correctly, the marks you will get for the first question is 2, second question is 3 and third question is 5.
However, if you leave a question or answer a question wrongly, the sequence is broken, and you will start again from 2.
Wrong answers have negative marks, again determined by the Fibonacci Sequence. It starts from the first term i.e, first wrong question gets -1 mark. If you get three wrong consecutively, you get -1, -1 and -2 respectively. And so on.

Proximity Scheme : *The closer you are to the question, the safer you are. You score 5 marks for giving the correct answer. You get 0 marks if you choose to not attempt the question. If the answer is wrong, but the difference between your answer and the correct answer is less than or equal to 25% of the correct answer, you get 0 marks. If the error is more than 25%, you get –3.*

Playfair Cipher

(Will be useful later on)

The Playfair cipher uses a 5 by 5 table containing a key word or phrase. Memorization of the keyword and 4 simple rules was all that was required to create the 5 by 5 table and use the cipher.
To generate the key table, one would first fill in the spaces in the table with the letters of the keyword (dropping any duplicate letters), then fill the remaining spaces with the rest of the letters of the alphabet in order (usually omitting "Q" to reduce the alphabet to fit; other versions put both "I" and "J" in the same space). The key can be written in the top rows of the table, from left to right, or in some other pattern, such as a spiral beginning in the upper-left-hand corner and ending in the center. The keyword together with the conventions for filling in the 5 by 5 table constitute the cipher key.

To encrypt a message, one would break the message into digrams (groups of 2 letters) such that, for example, "HelloWorld" becomes "HE LL OW OR LD", and map them out on the key table. If needed, append an uncommon monogram to complete the final digram. The two letters of the digram are considered as the opposite corners of a rectangle in the key table. Note the relative position of the corners of this rectangle. Then apply the following 4 rules, in order, to each pair of letters in the plaintext:

- *If both letters are the same (or only one letter is left), add an "X" after the first letter. Encrypt the new pair and continue. Some variants of Playfair use "Q" instead of "X", but any letter, itself uncommon as a repeated pair, will do.*
- *If the letters appear on the same row of your table, replace them with the letters to their immediate right respectively (wrapping around to the left side of the row if a letter in the original pair was on the right side of the row).*
- *If the letters appear on the same column of your table, replace them with the letters immediately below respectively (wrapping around to the top side of the column if a letter in the original pair was on the bottom side of the column).*
- *If the letters are not on the same row or column, replace them with the letters on the same row respectively but at the other pair of corners of the rectangle defined by the original pair. The order is important – the first letter of the encrypted pair is the one that lies on the same **row** as the first letter of the plaintext pair.*

THE SELECTION

Type of Questions: Multiple Choice
Marking Scheme : All or Nothing (8 marks)

In the memory of Cedric Diggory, Hogwarts decides to host the Tri-wizard Tournament in the year following Cedric's death. Professor Umbridge however thought the usual selection process was too dangerous and decided to conduct a written test. The test had one puzzle and the first three people to solve it were to be crowned as the champions of the tournament.

Question 1 :
There are five boggarts placed in a maze on blocks A,B,C,D and E. Every student starts on Block X, and can control the movement of other blocks. The objective is to take their wands from the centre of the maze and use it to shoot the boggarts

As the maze is enchanted, there are restrictions on the movement of the blocks. Each block can be made to travel horizontally or vertically, but only directly towards another block -- as far as it can go until hitting it edge to edge. One set of move is a continuous sequence of such movements made by the same block. Each move is indicated by the block's letter followed by the directions traveled: up (U), Down (D), left (L), and right (R). For Example, X- RUL is one move, which states that Block X first moved Right, then Up, then Left. How many times does each of the blocks,student move? (A, B, C, D, E, X) and total set of moves?

	A		B	C
				D
		■		
E				
				X

a) 1,3,2,0,2,4 and 6
b) 1,3,2,0,2,4 and 5
c) 0,3,1,3,0,5 and 7
d) 1,3,1,0,2,4 and 5

TIME TO TRAIN!

Type of Questions: Multiple Choice
Marking Scheme : Power Scheme

Harry Potter, Viktor Krum and Fleur Delacour emerge as the Champions of the Tri-Wizard Tournament again. We do hope things turn out differently this year. To increase Hogwarts' chances of winning the cup again, Professor McGonagall decides to put harry through some of her own puzzles.

Question 2:
Professor McGonagall digs up some history and brings out a rather intriguing example of a House Cup when only 3 houses competed viz. Gryffindor, Ravenclaw and Slytherin. The three houses participated in a series of events. Points were awarded for 1st, 2nd, and 3rd place in each event (the same points for each event, i.e. 1st always gets "x" points, 2nd always gets "y" points, 3rd always gets "z" points), with $x > y > z > 0$, and all point values being integers.

In that House Cup,
- *Gryffindor finished first overall with 22 points.*
- *Slytherin won the Quidditch event and finished with 9 points overall.*
- *Ravenclaw also finished with 9 points overall.*

Which house finished second in the O.W.L (Ordinary Wizarding Level Examinations, it was one of the events in the House Cup that year) ?

a) Gryffindor
b) Slytherin
c) Ravenclaw

Question 3:

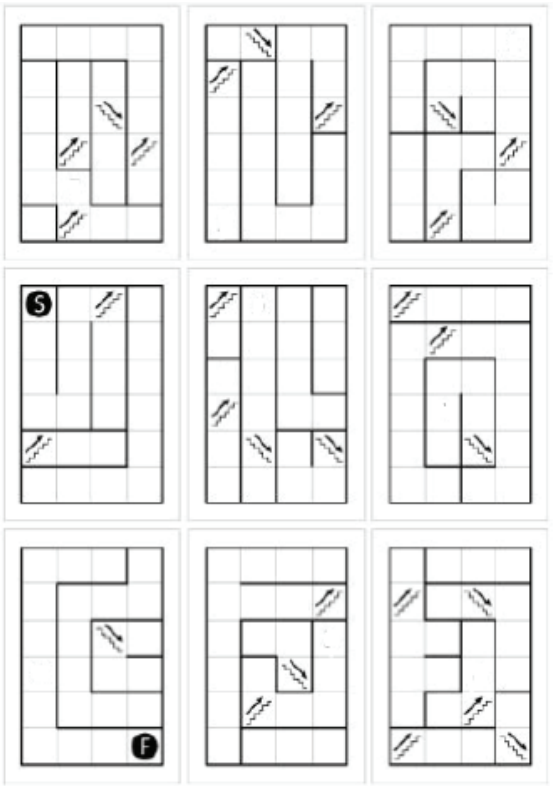
After that gruesome challenge, Professor McGonagall decides to test Harry with one of her favourite puzzles.

In a party, Minerva and her friends decide to play a party game with cards. There are 20 cards arranged in a row on the table. Each card is showing a positive integer. On each player's turn, he is allowed to take either the left most or right most card. This is done until all the cards are taken. The winner is the player who has the greatest sum of numbers on his/her cards. What should be Minerva's first move so that she can win the game?
The sequences are: A -> 2 11 13 8 12 5 6 8 9 21 10 7 15 17 18 4 16 18 19 1
B ->12 18 13 4 8 16 17 5 3 19 21 1 6 11 12 18 14 15 6 9

a) 1 from A and 9 from B
b) 2 from A and 12 from B
c) 2 from A and 9 from B
d) she cannot win in any case

Question 4:

For the final puzzle before the first round, professor McGonagall takes Harry to a dungeon. The 9 floors of the dungeons are shown below as 9 cards.The floor have gotten out of order, so Harry has to stack them up again. When they are stacked correctly, they will contain a path from the start (S) on the bottom floor to the Finish (F) on the top floor that goes through every up and down stairway. As Harry travels the path, every time he hits an up stairway, he must go to the square with the same coordinates on the floor immediately above the one he's on. Likewise, when he hits a down stairway, he must go to the square with the same coordinates on the floor immediately below the one he's on.Harry cannot cross the enchanted black walls or retrace his path. The cards are given the values 1-9 row wise starting from the left for every new row.

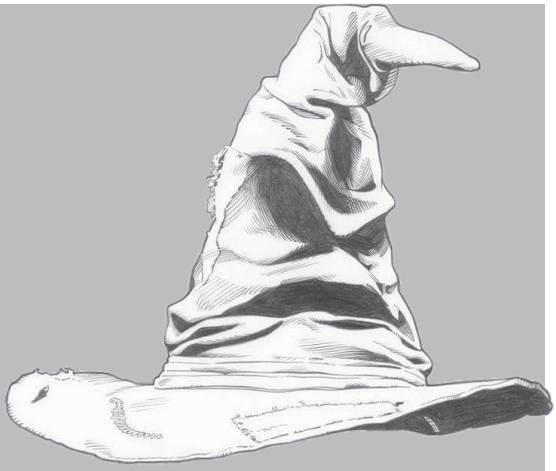


*In the final arrangement, let the card corresponding to ith floor be called ci. Then, the value of [(c1*c9)+(c2*c8)+(c3*c7)+(c4*c6)+c5] is?*

a) 73
b) 57
c) 83
d) 79

THE TRI-WIZARD TOURNAMENT STARTS

Type of Questions: Multiple Choice
Marking Scheme : All or Nothing (12 marks)



Question 5:

The first round of the competition was hosted by The Ministry of Magic. The Ministry recently got hold of some possessions of a death eater. However, they had to find the decrypting charm to find information about the whereabouts of the other death eaters from a talking hat. The Hat gave out 3 hints to deduce the charm. If one could not guess the right charm in 3 attempts, the hat will destroy itself.

The first hint given by the hat was,

*"**BFplmNVNbACLAMlrBgmDSllV iSTjfJsehRTgsRtM**"*

Harry is clueless and hence takes Hermonie's help. Hermione figures out some tricks and gives Harry a charm which read as,
*" **NEw loGYGnPULPOliNs oF AllY HaD be Back I D saId O** ". However, it turned out to be wrong. The hat then gave out the second hint, " **A failed attempt means you've either forgotten the password-protected, or you're trying to hack it. Luckily, I've decided to play fair. Remember that it would be wise to pay close attention to the capitals.**"*

*Capitals! Of course! Hermione instantaneously thinks of something, and gives Harry a new charm "**NG TO THE CHINKS OF PURPRI**". However, this also turned out to be wrong. This time instead of a hint, a warning message is read aloud. "**WARNING**: You have one attempt remaining before the data corrupts. Remember, this data is a matter of **life** and **death**! Use your last guess wisely…" it says. Viktor and Fleur give up, however, Harry has one more chance to find the information.*

The Ministry of Magic also got hold of this document along with the hat.

CODE	COUNTRY	CAPITAL
BF	Burkina Faso	Ouagadougou
PL	Poland	Warsaw
MN	Mongolia	Ulaanbaatar
VN	Viet Nam	Hanoi
BA	Bosnia and Herzegovina	Sarajevo
CL	Chile	Santiago
AM	Armenia	Yerevan
LR	Liberia	Monrovia
BG	Bulgaria	Sofia
MD	Moldova	Chisinau
SL	Sierra Leone	Freetown
LV	Latvia	Riga
IS	Iceland	Reykjavik
T3	Tajikistan	Dushanbe
F3	Fiji	Suva
SE	Sweden	Stockholm
HR	Croatia	Zagreb
TG	Togo	Lome
SR	Suriname	Paramaribo
TM	Turkmenistan	Ashgabat

Do you think this document is useful? Can you help Harry find the charm?
What will be the sum of the alphabets of the words if values to the alphabets are A=1, B=2, C=3, ... ?

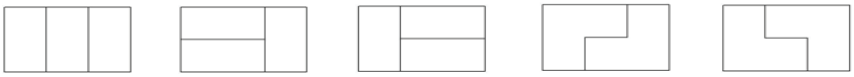
a) 286
b) 296
c) 316
d) 326

Question 6 :

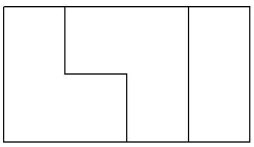
It was time for celebrations in the Gryffindor common room. But as luck would have had it, Seamus miscued a spell setting the common room floor on fire. The students were evacuated quickly. Dumbledore was informed of this act and he thought of the perfect punishment for Seamus.

He had to tile the common room without using magic (of course). The room was two units wide and N units long. Seamus was provided with two types of tiles: a rectangle that is one unit wide and two units long, and a L-shaped tile covering 3 square units. Pictures of the tiles are shown below. Seamus was allowed to rotate the tiles as he laid them. He had an unlimited supply of tiles. He however failed, and requested Harry to help. Harry said that he could only tell the number of different ways of tiling the room using these tiles.

For instance, a 2 x 3 room could be tiled in 5 different ways as follows:



Notice that the tiling could use both types of tiles. Consider the tiling of a 2 x 4 room below.



Seamus then asks Harry for the number of different ways of tiling a room of dimension 2 x 12. What would be Harry's answer?

a) 1055
b) 1255
c) 1455
d) 1450

DURMSTRANG AND BEAUXBATONS PREPARE

Type of Questions: Integer Type
Marking Scheme : Fibonacci Sequence

Seeing Hogwarts take a lead in the first round did not go very well with other two schools. Both schools decided to train their champions but Igor (Viktor's mentor) just received a letter summoning him to Azkaban for some formal work.

In the land of north sea, Galleon was not the form of currency, he had to convert his Galleons into Azkaban Units. He hence has an arrangement with Gringotts to exchange his cash for Azkaban Units. He decides to test Viktor based on this.
Igor will spend a fixed amount of Azkaban Units every day. At the beginning of every day, he decides whether or not he needs to buy more Azkaban Units for the day. He must always have enough Azkaban Units to meet the day's expenses. The exchange rate fluctuates, so sometimes he buys surplus Azkaban Units to take care of future days' expenses. However, there is a limit on how many Azkaban Units he can have with him at any time. Assuming that he knows in advance the exchange rates for each day, he would like to come up with the perfect strategy for buying Azkaban Units so that his overall cost in galleons is minimized.
For example, suppose Igor spends 6 days in Azkaban with daily expenses of 1 Azkaban Units per day and he is allowed to have at most 6 Azkaban Units with him at any time. Further, suppose that the exchange rate over these 6 days are as follows:

Day: 1 2 3 4 5 6
Exchange Rate: 6 6 7 7 7 5 (Galleons per Azkaban Unit)

Then, his minimum overall cost is 35 Galleons. To achieve this, he can buy 5 Azkaban Units on day 1 at a cost of 30 Galleons. This takes him through the end of day 5. On the sixth day, he buys one more Azkaban Unit for 5 Galleons to meet his expenses on that day. Notice that if he had bought the maximum possible amount, 6 Azkaban Units on the first day, he would have spent 36 galleons overall.

So, now in each of the following cases, Viktor has to calculate the minimum expenditure in galleons.

Question 7.

Number of days: 15

Daily Expenses: 2 Azkaban Units per day

Maximum cash he can have at any time: 5 Azkaban Units

Daily Exchange rate:

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Exchange Rate:	5	1	4	2	4	2	1	3	4	4	1	5	2	3	3

Question 8.

Number of days: 20

Daily Expenses: 1 Azkaban Unit per day

Maximum cash he can have at any time: 4 Azkaban Units

Daily Exchange rate:

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Exchange Rate:	4	2	1	1	3	1	6	3	4	5	5	4	1	5	4

Day	16	17	18	19	20
Exchange rate	6	6	4	3	1

Igor hopes that Viktor will solve the puzzles before he returns from Azkaban and he promises to train Viktor with more challenging puzzles ahead.You have to report the sum of the product of digits in the OMR sheet i.e if minimum expenditure is 26, report your answer as 3 (2 x 6 = 12 => 1+2 = 3)

Question9:

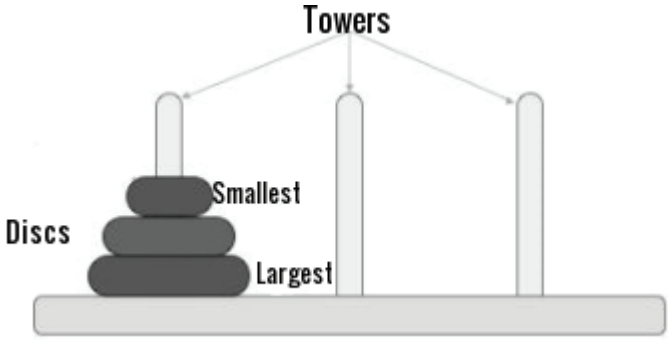
Igor returns from Azkaban 2 days later and finds out that Viktor had solved the puzzles quite easily. So he decides to raise the stakes. He takes Viktor to the room with the life sized chessboard. Viktor was a rather famous chess player, so he didn't mind. Igor was aware of this, so he brings in a new piece, a SuperQueen.It can perform all moves of a queen as well as a knight.

Igor gives Viktor 10 SuperQueens and increases the chess board's dimensions to 10 x 10. He then asks for the number of possible ways that all 10 pieces can be placed on the board without coming in each other's path.

What is the answer?

Question 10:

Tower of Hanoi, a famous Beauxbatons puzzle which consists of three towers (pegs) and more than one rings, is as depicted −



These rings are of different sizes and stacked upon in an ascending order, i.e. the smaller one sits over the larger one. There are other variations of the puzzle where the number of disks increase, but the tower count remains the same.

Rules:

The mission is to move all the disks to another tower without violating the sequence of arrangement. A few rules to be followed for Tower of Hanoi are −

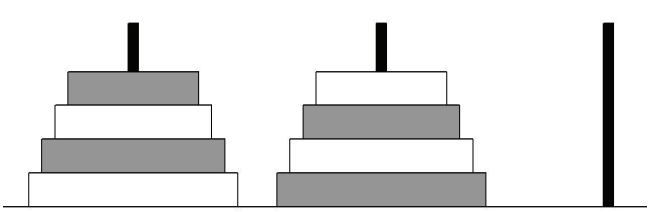
1. *Only one disk can be moved among the towers at any given time.*
2. *Only the "top" disk can be removed.*
3. *A larger disc cannot be placed on a smaller disc.*

For instance if we take 3 discs in 1st peg saying it as peg A it will take 7 steps to take it to 2nd peg.

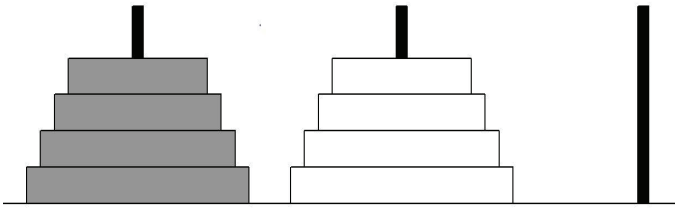
The following variation of the famous TOWER OF HANOI puzzle was offered to Fleur Delacour by Madame Maxime in order to get the location of the next puzzle by Madame Maxime which was locked inside a box.

The rules of the puzzle are essentially the same: disks are transferred between pegs one at a time. At no time may a bigger disk be placed on top of a smaller one. The difference is that now for every size there are two disks: one green and one red. Also, there are now two towers of disks of alternating colors. The goal of the puzzle is to arrange all red discs on one tower, and all green discs on another. The biggest discs at the bottom of the towers are assumed to swap positions.

For instance:



Initial configuration of Bicolour Tower of Hanoi (n=4)

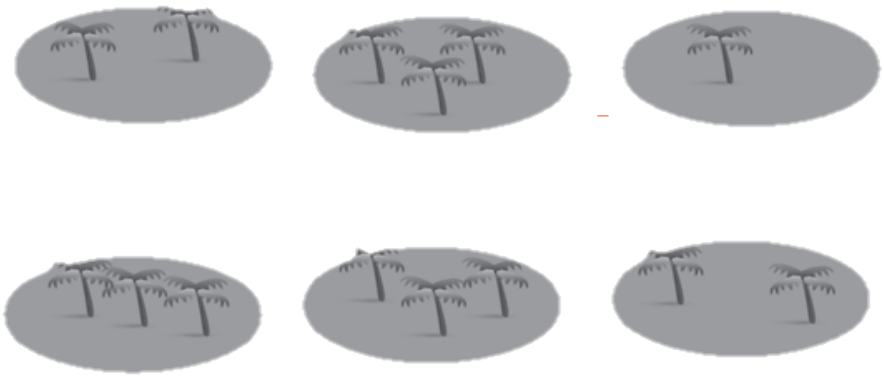


Final Configuration of Bicolour Tower of Hanoi (n=4)

Now Fleur is given 6 discs of each colour(n = 6) arranged in the same way as the initial configuration. What are least number of moves she will need in order to get the location of the next puzzle?

Question11:

The location of the next puzzle was the Isle of Drear, a combination of 6 islands joined by a system of bridges designed by Dumbledore himself. Madame Maxime gives Fleur the same condition that Dumbledore was posed with when he was designing the network of bridges.



Madame Maxime asked Fleur the total number of distinct ways to join the six islands shown above by bridges such that:

1. each island can be reached from any other island via the bridges,
2. 1 of the islands has 1 bridge leading from it
3. 2 of the islands each have 2 bridges leading from them, and
4. 3 of the islands each have 3 bridges leading from them.

Madame Maxime also gave some more details and assumptions:

1. Neither of the 2 islands on the far left can be joined directly to either of the 2 islands on the far right.
2. There can be more than 1 bridge between 2 islands.
3. Mirror images and 180-degree rotations are not counted as distinct.
4. Diagonal bridges are not allowed.

As the next round of the tournament was set up by Dumbledore, Madame Maxime thought it could help Fleur if she thought in the same lines as Dumbledore once did.
Can you guess the total number of ways?

THE SECOND ROUND

Type of Questions: Multiple Choice
Marking Scheme : All or Nothing(8 marks)

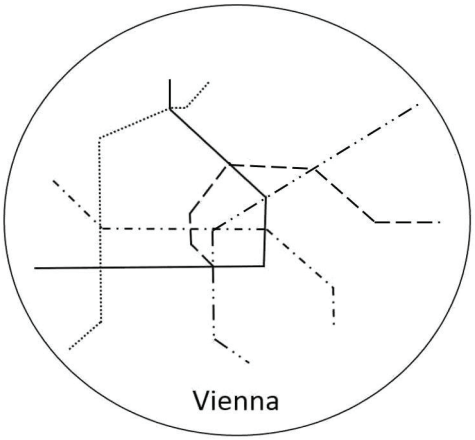
Question12:

Designed by Dumbledore himself, this round was supposed to be the most adventurous. The objective of the event was to infiltrate a secure location(code named VIENNA) in Hogwarts and to secure your best friend who has been trapped there. You have to exit the location through the tunnel networks whose blueprint is given below.

As seen in the picture there are 5 tracks (Green, Brown, Red, Violet, Yellow). The time taken to travel between 2 junctions along the respective lines is given below.

Green – 5 mins, Brown – 4 mins, Violet – 3 mins, Yellow – 2mins, Red- 1 min.

Harry will start from the left end of the green track and his aim is to reach the right end of the Red/Violet/Yellow Track as quickly as possible.



Red : Brown : Yellow :

Violet : Green :

But each track has 2 guards starting from each end of the track except for green track (has only one guard starting from the right end). The guards take two minutes to travel between any two junctions(intersecting points between tracks are junctions not the bending points) and wait for 30 seconds at each junction. Guards will change their direction once they reach the end of their track. The guard and the player should not move across each other at any instant of time.

The player cannot reuse the paths between junctions i.e each path cannot be used more than once. Note that if you enter a junction at time x and the guard leaves that junction at the same time then you are not caught.

What is the time taken by Harry if he reaches as soon as possible ?

THE YULE BALL

Type of Questions: Multiple Choice
Marking Scheme : Power Scheme

Question13:

It's time for one of the most awaited events of the Tri-Wizard Tournament, The Yule Ball. Viktor Krum decides to ask out Hermione as his date for the ball. Knowing how smart she is, he decides to impress Hermione by scoring the highest ever score in one the most played games at Hogwarts
The game is described as follows:

This is a game played with a sequence of tiles, each labelled with two numbers. You start at the first tile in the sequence and choose one number from each tile that you stop at, according to the following rules:

- *At tile i, if you pick up the smaller number, you move on to the next tile, i+1, in the sequence.*
- *At tile i, if you pick up the larger number, you skip the next tile and move to tile i+2 in the sequence.*

The game ends when your next move takes you beyond the end of the sequence. Your score is the sum of all the numbers you have picked up. The goal is to maximize the final score.

For example, suppose you have a sequence of four tiles as follows:

Tile 1	Tile 2	Tile 3	Tile 4
1 (2)	1 3	(1) -1	-2 -3

Then, the maximum score you can achieve is 3, by choosing the numbers that are circled.

In each of the cases (a) and (b) below, compute the maximum store that Viktor can achieve by picking up numbers according to the rules given above.

(a)

Tile 1	Tile 2	Tile 3	Tile 4	Tile 5
2 −2	−3 −2	−3 −1	1 2	1 −5

Tile 6	Tile 7	Tile 8	Tile 9	Tile 10
4 −2	−4 −5	4 −5	−2 −5	5 4

(b)

Tile 1	Tile 2	Tile 3	Tile 4	Tile 5	Tile 6
1 −1	−3 1	4 −1	−3 4	1 2	4 3

Tile 7	Tile 8	Tile 9	Tile 10	Tile 11	Tile 12
3 −4	4 1	4 2	−1 1	−2 −1	−3 −4

a) 14, 14
b) 13, 14
c) 14, 15
d) 14, 16

Question14:
Viktor got very famous in Hogwarts after he broke all records in the tile game. Even Hermoine was impressed. Ron out of envy, decided to challenge Viktor with one of his chess puzzles. If Viktor could not solve the puzzle, Viktor can not ask Hermoine out to the ball. Viktor needs all the help he can to solve the puzzle, so help him out.
The puzzle is described as follows:

On a 3x3 chess board, 4 knights, 3 rooks and 2 bishops (of the same color) must be arranged in such a way that each piece must be protected:

1. in the final arrangement.
2. in the positions where either of the 4 knights / 3 rooks / 2 bishops are placed in their final place.

Let the pieces be assigned numbers as follows: Knight=2, Bishop=3, Rook=5 on black squares and respective negative values on white squares. Find out the "sum" of all pieces in the arranged position. (Assume there are 5 black squares on the chess board).
a) 1
b) 6
c) 9
d) 13

Question 15:

The night of The Yule Ball was one of the most fun nights Hogwarts had seen in a long time. There was dance, music, food and what not. Luna Lovegood also had a pumpkin juice stall of her own which was quite a hit that night. She had brought 12 cartons of pumpkin juice for her stall and it finished in no time. At last only two of the bottles were left. Crab, Goyle and Harry, Ron approached the stall to buy 2 pumpkin juice bottles unaware of the fact that only two bottles were left.

As they reached the stall at the same time, Luna decided to give both the parties a fair chance of earning the pumpkin juice bottles.

She arranged 12 cartons in 3 x 4 grid and labelled them as A,B,C….L.

A	B	C	D
E	F	G	H
I	J	K	L

She has randomly chosen two of the cartons and hidden pumpkin juice bottles inside each of them, leaving the remaining ten cartons empty. She gives the dozen cartons to Crab, who opens them in the order A, B, C, D, E, F, G, H, I, J, K, L until he finds one of the bottles, whereupon he stops. The number of cartons that he opens is his score. Luna then reseals the cartons, keeping the bottles where they are, and presents the cartons to Ron, who opens the cartons in the order A, E, I, B, F, J, C, G, K, D, H, L, again stopping as soon as one of the bottles is found, and scoring the number of opened cartons. Whoever scores lower wins the game; if they score the same then it's a tie.

For example, suppose Luna hides the bottles in cartons H and K. Then Crab will stop after reaching the bottle in carton H and will score 8, while Ron will stop after reaching the bottle in carton K and will score 9. So Crab wins in this case.

Who is more likely to win this game?

a) Ron
b) Crab
c) Both are equally likely to win

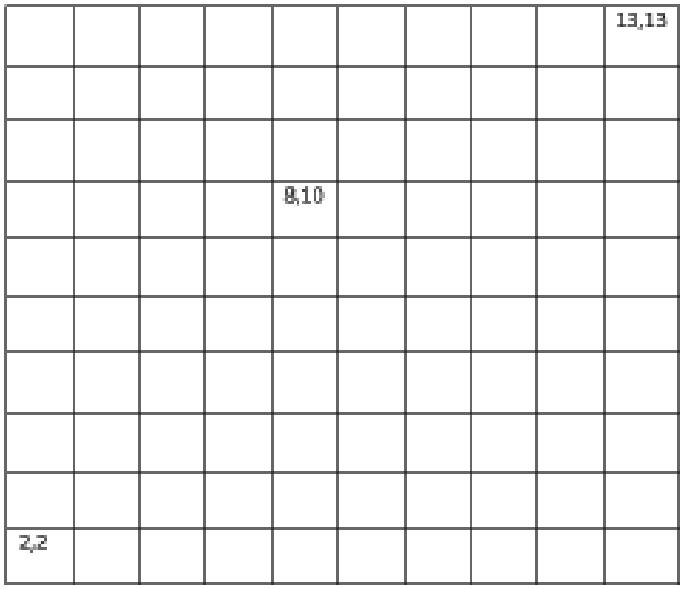
FINAL PREPARATION

Type of Questions: Integer Type
Marking Scheme : Proximity Scheme

As the tournament approached its final stage, Hogwarts decided to leave no stone unturned to prepare Harry for the challenges that lay ahead. They decided to bring in Hagrid, who specialises in Magical Creatures, and Mad Eye Moody to train Harry.

Question 16 :

Harry first faces Hagrid's Puzzle. Hagrid believes that the best way to teach Harry about magical creatures is by getting him to interact with them. Hagrid decides to make this a little interesting. Hagrid takes Harry to the Enchanted Forest. Hagrid with some help from Dumbledore divides the forest into several cells, each with it's own coordinates as shown below. Each charm has a magical creature. Harry will start at (8,10). A spell has been laid so that movement between these cells is restricted. If your position is (a,b), you can only move to (a,a+b), (a,a-b),(a+b,b), (a-b,b), (b-a,b) and (a,b-a). Harry can continue until there is no other magical creature under his reach. Harry wants to make the most of this exercise and learn as much as possible. What is the largest possible number of Magical Creatures he will be able to meet?



Question 17.

Now with Hagrid's task out of the way, Harry now faces Mad Eye Moody. Moody has prepared a special mechanical puzzle for Harry.

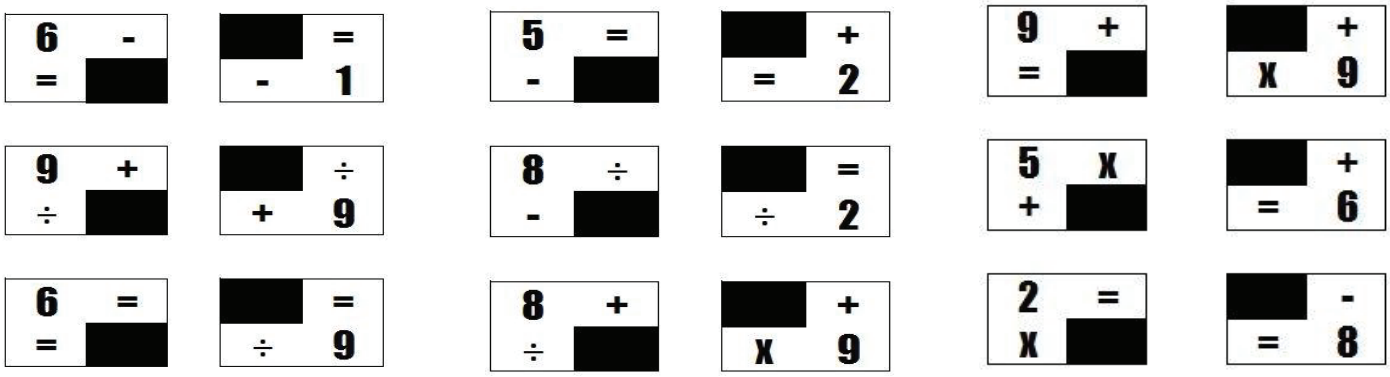
There are 9 cubes, whose front and back sides are shown in the image below. The image on the left is the front, and right next to it is the back. The task is to arrange them in a 3x3 grid. The following conditions need to be followed:

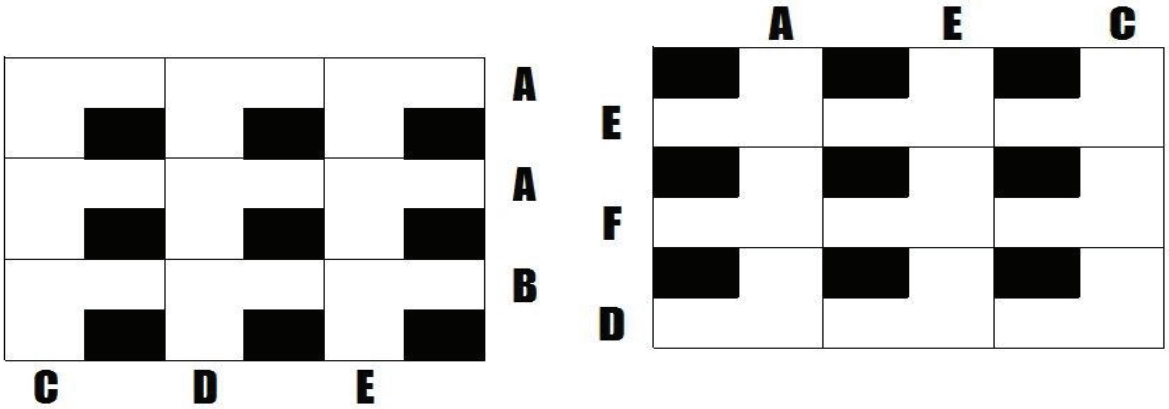
- *Each letter from A to F need to be replaced with a unique number from 1-9. No two alphabets can be replaced with the same value. Once a number is assigned to an alphabet, the alphabet is always replaced by the same number. For example, if A is assigned the value 1, wherever there is a A, it will take the value of 1.*
- *The Black region should be aligned with the Black region on the grid.*

When arranged, each equation reading from left to right, and each equation read up to down, should be correct.

- *When the entire arrangement is turned upside down, and placed on the 2nd grid, similarly, all equations should be correct.*

All calculations are performed in order from left to right, or top to bottom, and each individual calculation results in a positive integer value (no negative numbers, zeros, or fractions ever need to be used).
What is the value of (A x B) + (C x D) + (E x F) ?





THE FINAL ROUND: TRI-WIZARD MAZE

Type of Questions: Multiple Choice
Marking Scheme : Power Scheme

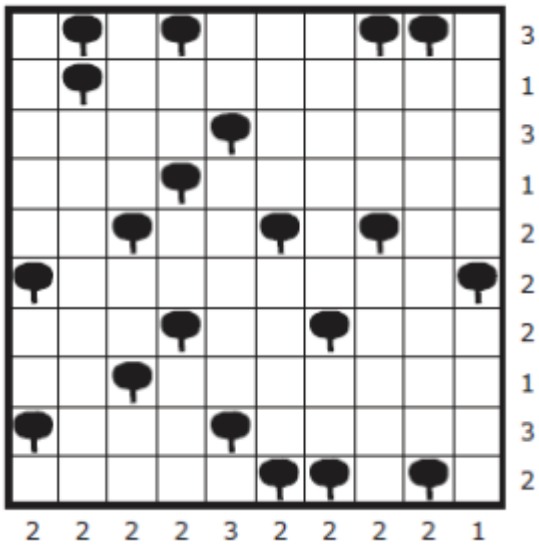
There was absolutely no doubt that the final round of the tournament would be the haunted tri-wizard maze and this time the maze was filled with dementors who were desperately waiting for their prey.
Before entering the maze, the champions had to earn their wands and also determine the right path to enter the maze

Question 18
To earn his wand, Harry was given 4 ropes and a lighter. Each rope burns at a non-constant rate but takes exactly one hour to burn completely from one end to the other. Harry can only light the ropes at either of their ends but can decide when to light each end as he sees fit. The goal is to use the ropes to measure time. For example, the time taken to burn one rope if burnt from only one end is 1 hour. So 1 hour can be measured using the ropes. Similarly, at max, how many lengths of time can be measured using these ropes? The right answer earns him his wand.

a) 20
b) 23
c) 26
d) 29

Question 19.
Which of the following time intervals can be measured using 4 ropes and a lighter? (Multiple answers are correct, marking all of them will get you points)

a) 52.5
b) 78.75
c) 71.25
d) 90.25



Queston 20 :

Now armed with their wands, the champions enter the maze. The maze is divided into boxes and trees are placed in some of those boxes (1 tree per grid), a dementor is waiting for Harry on every tree, the only way Harry can stop dementors from following him if he places one of his patronus stags adjacent to every tree. There is a number mentioned outside every row and column that indicates the number of patronus stag to be placed on every row and column. The value of every box in the maze is given by the product of the the row and column number(eg, value of top left box is 2 x 3 = 6). Harry manages to strategically place stags all over the maze. What do you think will be the sum of values of all boxes in which stags are placed?

a) 39
b) 32
c) 47
d) 43

After successfully fighting of the dementors in the tri-wizard, Harry finally reaches to the end of the maze and grabs the Tri-Wizard Cup which again turns out to be a port key and it transports Harry to IIT Guwahati where more challenges await.

Instructions for TechnoFin

(Please read this before attempting the section - TechnoFin)

Introduction

Perturbed by the inadequate and below par Financial literacy among school students in our nation, The Finance and Economics Club, IIT Guwahati introduces its initiative, TechnoFin in association with Technothlon to foster the Financial literacy.

You can follow the Finance and Economics club IIT Guwahati at - www.facebook.com/financeclubiitg

General Instructions

1. *Verify that there are 4 questions under TechnoFin.*
2. *Write the answers in the TechnoFin section given at the end of the OMR.*
3. *All answers must be clear and legible. In case of any ambiguity, the decision of evaluator is final.*
4. *No queries regarding the correctness of the questions shall be entertained.*
5. *It is **not compulsory** to attempt TechnoFin.*

NO MARKS AWARDED FOR TECHNOFIN WILL BE INCLUDED IN TECHNOTHLON.
EVERY TEAM ATTEMPTING TECHNOFIN WILL GET AN E-CERTIFICATE FROM THE FINANCE AND ECONOMICS CLUB, IIT GUWAHATI.
STUDENTS WHO WILL OUTPERFORM THE OTHERS WILL GET A SPECIAL ACKNOWLEDGMENT E-CERTIFICATE FROM THE FINANCE AND ECONOMICS CLUB, IIT GUWAHATI.

TechnoFin

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(NO MARKS AWARDED FOR TECHNOFIN WILL BE INCLUDED IN TECHNOTHLON.)

Marking Scheme:

To understand marking scheme, read following paragraph first.

Ever wondered why the rupee quotes at 65.2 or 60 and not at Rs. 20 or Rs. 80 to a dollar?

It's not much different from how the prices of your mangoes are determined, for example. Whether currency movements or prices of mangoes, the most important factor determining their price is the same – market forces of demand and supply. If the demand for dollars' increases, the value of dollar will appreciate. As the quotation for Rs/$ is a two-way quote (that is, the price of one dollar is quoted in terms of how much rupees it takes to buy one dollar), an appreciation in the value of dollar would automatically mean a depreciation in Indian rupee and vice-versa.

For example, if rupee depreciates, a dollar which once cost Rs. 47 would cost, say, Rs. 50. In essence, the value of dollar has risen and the buying power of rupee has gone down.Besides the primary powers of demand and supply, the rupee-dollar rates are determined by other market forces as well.

So, here we will not count your marks but will count your virtual money. On solving question correctly, you will get virtual money (as currencies of different countries). At last, your total will be converted to Indian rupee.

Virtual Money Allocation (Marking Scheme):

Question 1 -₹ 20 *Question 2- 1 $ (1 US Dollar (1 $) = ₹65)*

Question 3- 2 € (1 euro (1 €) = ₹70) *Question 4- 2 £ (1 British Pound (1 £)= ₹ 80*

Question 5- 1 KD (1 Kuwaiti Dinar (1 KD) = ₹ 210 (KD is world's highest-valued currency unit)

Question 1. *The central banking functions in India are performed by the*

I.Central Bank of India *II.Reserve Bank of India*

III.State Bank of India *IV.Punjab National Bank*

a) I and II
b) II only
c) I only
d) II and III

Question 2: *Devaluation of a currency means*

a) reduction in the value of a currency vis-a-vis major internationally traded currencies
b) permitting the currency to seek its worth in the international market
c) fixing the value of the currency in conjunction with the movement in the value of a basket of predetermined currencies
d) fixing the value of currency in multilateral consultation with the IMF, the World Bank and major trading partners

Question 3: *Foreign direct investment (FDI) is an investment made by a company or individual in one country in business interests in another country, in the form of either establishing business operations or acquiring business assets in the other country, such as ownership or controlling interest in a foreign company.*
In the last one decade, which one among the following sectors has attracted the highest foreign direct investment(FDI) inflows into India?

a) Chemicals other than fertilizer *b) Services sector*
c) Food processing *d) T elecommunication*

To solve question 4 & 5 read following information carefully,

A balance sheet is a financial statement that summarizes a company's assets, liabilities and shareholders' equity at a specific point in time. These three balance sheet segments give investors an idea as to what the company owns and owes, as well as the amount invested by shareholders.
The balance sheet adheres to the following formula:
Assets = Liabilities + Shareholders' Equity

Question 4: *Financial statements mainly help in*

a) Assumption of economic events *b) Anticipation of economic events*
c) Recording of economic events *d) Communication of economic events*

Question 5: *Accounts payable, accruals and notes payables are listed on balance sheet as*

a) accrued liabilities *b) current liabilities*
c) accumulated liabilities *d) non current liabilities*

A word from organizers of Technothlon 2017

Hello,

We hope you enjoyed these last two and a half hours, racking your brains and trying to find your way through what is arguably one of the most challenging exams for school students. We're sure a lot of thoughts must have crossed your mind while you were trying to solve the paper, ranging from " This is ridiculous" to "Who even makes these questions?!". While some people from our little team might disagree, we have had a blast making these questions.

It was important that we asked ourselves what we wanted to achieve with our question paper. Did we want it to be the toughest technothlon paper yet? Did we want it to be something completely different? But we soon realised that, over the years, as Technothlon has continued to grow, so have expectations regarding the exam. The technothlon paper is expected to be challenging, logical, and most importantly, fun. This year, we have tried to not just live up to these expectations, but exceed them. Countless number of sleepless nights have gone into making this paper as fun, as challenging and as logical as possible. Do not be disheartened if you could not solve the questions during the exam. Our aim was not to just test your mental prowess, but instead help you improve it. We hope that you will take this paper up as a challenge and try to solve it even after the exam is over. Our aim was not just to select the brightest young minds across the country, but to inspire one and all. We hope that the prospect of winning a trip to NASA and coming to IIT Guwahati would have motivated you enough to give it your best shot. We hope to see you there and wish you all all the best.

And finally, the chief organizers of Technothlon '17 thank all the city reps for making our dream a reality. Thank you all for working continuously, regardless of the summer heat or the cold winter breeze, and spreading the word of Technothlon in cities all across the country. We hope you have learnt a lot from this experience. A special word of thanks to all the faculty coordinators, organizers, volunteers and invigilators, who were instrumental in the smooth conduction of the paper. And last but not the least, a very special thank you to our little team who have helped us design this labyrinth of puzzles that you have been solving for the last two and a half hours.

Hope you had fun!

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 ***co****nstructive 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

Jitika Rajpoot
Pratyay Prakash Nigam
Yash Gandhe
Udayraj Deshmukh
Likhita Konjeti
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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. This year, several illustrious speakers such as Dr. Nadrian Seeman (Inventor of DNA Nanotechnology), Mr. Mike Morasky (Visual Effects Artists at Valve Corporatio), Mr. Patrick Plourde (Creative Director at Ubisoft, worked on Assassin's Creed and Far Cry) and Thomas Barclay (Senior Research Scientist, NASA) will be gracing the stage. 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.

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 2017.

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 eort to provide holistic development of society as a unit.

ROBOTICS

The Robotics module of Techniche 2017 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 flow. 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.

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(Do all the rough work here)

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