Exun 2018

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College Counseling

The Turing Test

Final Round

Instructions To Candidates

1. The Turing Test Finals will have **three questions**, with **four hours** to submit the solutions. The points scored for each problem are mentioned on the question paper itself.
2. Participants are required to submit their responses by answering **each problem on a separate sheet**, and ensuring that the **names of the participants are written on all the sheets used, including rough sheets.**
3. In case of any doubts or clarifications, raise your hand to ask one of the volunteers. Communicating with any participants other than your team members is not allowed.
4. Ensure that each answer is accompanied by a substantive explanation of the linguistic phenomenon that is taking place. Well-explained solutions will be awarded more points as compared to simply giving the answers themselves. Note that we do not require you to explain how you arrived at the answer. For example in English, we require you to explain a rule as: *plurals of some words are made by suffixing -s to the singular form*. We do not need you to tell us that you found the rule from looking at the plural forms of the nouns *apple*, *banana*, etc. In short, simply tell us your conclusions, and the rules you discovered to help you arrive at the conclusions, not the examples that demonstrate these rules.
5. Use of the Internet is not allowed, and participants are forbidden from using mobile phones, smartwatches or any devices that can be used to access the Internet. Any external materials, such as notes, chits or charts, are also not allowed.
6. We recommend that everyone submit their solutions 5-10 minutes before the event finishes, in order to avoid delays.
7. There is NO NEGATIVE MARKING, feel free to guess!

GOOD LUCK!

Problem 1: Fibbing About Fibonacci (20 Points)

Sarthak Mangla

In the great nation of Sagaland, there once ruled a benevolent king Sago. Sago was very fond of mathematics, and he invited several mathematicians to design problems for the annual Sagaland Algebra and Geometry Olympiad (also abbreviated to SAGO), a math contest for school students. These mathematicians then told Sago that they had already created a problem based on a Master Set of the Fibonacci Sequence.

A Sequence, in Sagaland, is a list of comma separated numbers, in which the i^{th} term can be expressed using some magical mathematical rule. The Fibonacci Sequence is defined using 2 initial terms, *a* and *b*, which can then be used to create a sequence in which the i^{th} term, A_i, can be given by: $A_i = A_{i-1} + A_{i-2}$. A Master Set of the Fibonacci Sequence is a set of sequences which are all determined using some common rules, and this set must also include the Fibonacci Sequence. One of the mathematicians has secretly told you rules of sequences in this Master Set, which is determined as follows: $A_i = A_{i-1} + A_{i-2}$ AND/OR $A_i = A_{i-2} - A_{i-1}$. This means that the {3, 4, 7, 11}, {3, 4, -1, 5}, {3, 4, -1, 3} are all sequences (of length 4, as they have 4 numbers) that follow one or both of these rules for any term A_i, and hence belong to the Master Set. The sequence that all terms are determined using only the first rule is the Fibonacci Sequence, which in this case is {3, 4, 7, 11}, and it is indeed in the Master Set.

Now the rulebook says that Sago should be able to solve all the mathematical problems, and only then can the problem be asked in SAGO, because Sago, being the ruler, will be the one correcting the papers as well. He told the mathematicians that he will use this problem in SAGO, and it is a very easily solvable problem. However he actually fibbed, because he is unable to solve this problem, and he needs your help in identifying the sequences given below before the mathematicians find out that he is lying. The only other thing Sago has been told by the mathematicians is that the first two terms, *a* and *b* are both 1, that is, $a=b=1$. These sequences all belong to the Master Set, but they are written in Solverese, a language used by the organisers of SAGO. Note that each sequence actually has length 8, but in Solverese, they may be written with a fewer number of words, that is, each word need not match exactly to one number of the sequence.

Sequence 1: see ju pise se fura see
Sequence 2: see fura se pise ju pike fe
Sequence 3: see fura se pise fura pise se
Sequence 4: see ju ke fe yu gocke jugocse
Sequence 5: see ju ke pise ju se ke

Assignment 1 (10 Points):
Convert the sequences into Hindu-Arabic numerals for the students participating in SAGO.

Assignment 2 (5 Points):
Translate the following numbers from Solverese to Hindu-Arabic Numerals.

1. Pijugocse
2. Fegocyu
3. Pisegocju
4. Kegocju
5. Fegoc

Assignment 3 (5 Points):
Explain how numbers are translated from Solverese to Hindu-Arabic Numerals, and how the sequences of length 8 can be represented using Solverese in fewer words.

Problem 2: A Futile Endeavour (20 Points)

Sagnik Anupam

The 42nd Shash, who is the captain of the *HMS Futile Endeavour*, is sailing southwards to the magical land of Woz, where, as would be told to children in history classes in later years, he will encounter gangurrus and Guugu people. He reaches the coast of Woz, and alights from his ship, accompanied by his trusted sailors and lieutenants, all members of Exun Clan. But whom should he meet on the coast but Sago, who is an explorer long presumed dead and vanished in the interior of Woz. Sago and the 42nd Shash knew each other a long time back, but to their dismay, they are unable to understand each other. What has happened is that while they both studied Classical Varadhuran as a language in school, and talked to each other quite a lot, the 42nd Shash, became a captain and is part of the rich elite who speak Modern Varadhuran. Sago, on the other hand, became an explorer, and shunning the company of elites in general, elected to live amongst the natives in Woz, who speak an ancient version of Classical Varadhuran called Caradhiran. The lieutenants and other Exun Clan members, however, are divided amongst the Modern Varadhuran speakers and the Classical Varadhuran speakers. Therefore, it is imperative that you need to translate the historic speech between Sago and the 42nd Shash for everyone to hear and understand, as well as record in history books.

By pooling together their common knowledge, the 42nd Shash and Sago have translated some words between Caradhiran, Classical Varadhuran and Modern Varadhuran. However, they are unable to proceed further. Their efforts are summarized in a table as follows.

Caradhiran	Classical Varadhuran	Modern Varadhuran
manus	mano	mani
umaru	umau	umaa
(1)	vandre	wandre
urestu	uestu	uesta
gunares	kunae	(2)
cahun	cahun	carun
umang	(3)	umankh
sururu	soou	(4)

zunres	zundre	zundre
(5)	(6)	akhawa
ulanru	ulandru	ulandra
(7)	ulohar	(8)
brahes	brahe	brare
agera	akea	akhea
(9)	(10)	khosandra
gugavira	kokavia	khokhawia

A tip for solving the problem: Remember how these languages have evolved. Caradhiran evolved to form Classical Varadhuran, which evolved to form Modern Varadhuran.

Assignment 1 (5 Points): Fill in the blanks of the table given above.

Assignment 2 (3.5 Points) : Translate the following Caradhiran words to Classical Varadhuran.

1. gumules
2. harahar
3. nanrus
4. uanres
5. ragarul
6. sugumra
7. sulus

Assignment 3 (3.5 Points) : Translate the following Classical Varadhuran words to Modern Varadhuran.

1. koho
2. sulu
3. vohoh
4. kosu
5. konoho
6. vako
7. Uesku

Assignment 4 (8 Points): Explain the rules for translation from Caradhiran to Classical Varadhuran, and the rules for conversion from Classical Varadhuran to Modern Varadhuran.

Problem 3: Cantonese and Cavineña (20 Points)

Sagnik Anupam

Sophie-Germain primes are a special type of prime numbers. A prime number *p* is a Sophie-Germain prime if both *p*, as well as *(2p + 1)* are prime numbers. We have a list of Sophie-Germain primes that are less than 100.

2, 3, 5, 11, 23, 29, 41, 53, 83, 89

Now, we all can read the numbers in English as two, three, five, etc. But what we feel is more interesting is to look at these numbers in other languages, and see how they are written.

For example, this is how some of these numbers would be read in Cantonese[1], although we have jumbled up their order.

yi sap gau, yi, ng sap saam, yi sap saam, sei sap yat, baat sap saam, ng, sap yat

Similarly, this is how another subset of these numbers (i.e. not exactly the same subset we chose earlier for Cantonese) would be read in Cavineña[2].

kimiɕa, peaɟa tʊŋka peaɟa earakana, beta, piɕika, beta tʊŋka pʊskʊrʊkʊ earakana, pʊɕi tʊŋka peaɟa earakana, piɕika tʊŋka kimiɕa earakana, kimisapakarʊkʊ tʊŋka kimiɕa earakana

Assignment 1 (10 Points): Find the correct correspondences between the Hindu-Arabic numbers, the Cantonese numbers, and the Cavineña numbers, and translate the numbers which are not part of the subsets. All the primes given in the problem should have 2 translations each.

Assignment 2 (5 Points): Translate the following numbers into their Cantonese and Cavineña equivalents:

A. 4 B. 35 C. 91 D. 15 E. 49

Assignment 3 (5 Points): Explain the rules for converting numbers from Hindu-Arabic Numerals to their Cantonese and Cavineña equivalents.

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[1] Cantonese is a variety of Chinese spoken in the city of Guangzhou, historically known as Canton, and its surrounding area in south-eastern China. It belongs to the Sino-Tibetan language family, and has approximately 80 million speakers.

[2] Cavineña is an endangered indigenous language belonging to the Pano-Tacanan family, spoken on the Amazonian plains of northern Bolivia by approximately 1200 people. Note that ɕ,ŋ and ɟ are consonants, while ʊ is a vowel.