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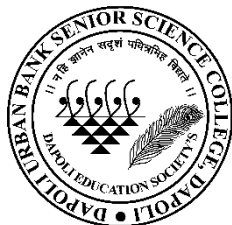*E-info letter*

SCIENCE

COMMERCE

SOCIAL SCIENCE

**VOL.- I
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How To Make Jet Fuel From Sunlight, Air And Water Vapor

Solar kerosene could replace petroleum-derived jet fuel in aviation and help stabilize greenhouse gas emissions, the researchers report in the July 20 Joule.

Burning solar-derived kerosene releases carbon dioxide, but only as much as is used to make it, says Aldo Steinfeld, an engineer at ETH Zurich. "That makes the fuel carbon neutral, especially if we use carbon dioxide captured directly from the air."

In 2015, Steinfeld and his colleagues synthesized solar kerosene in the laboratory, but no one had produced the fuel entirely in a single system in the field. So Steinfeld and his team positioned 169 sun-tracking mirrors to reflect and focus radiation equivalent to about 2,500 suns into a solar reactor atop a 15-meter-tall tower. The reactor has a window to let the light in, ports that supply carbon dioxide and water vapor as well as a material used to catalyze chemical reactions called porous ceria.

When heated with solar radiation, the ceria reacts with carbon dioxide and water vapor in the reactor to produce syngas — a mixture of hydrogen gas and carbon monoxide. The syngas is then piped to the tower's base where a machine converts it into kerosene and other hydrocarbons.

Over nine days of operation, the researchers found that the tower converted about 4 percent of the used solar energy into roughly 5,191 liters of syngas, which was used to synthesize both kerosene and diesel. This proof-of-principle setup produced about a liter of kerosene a day, Steinfeld says.

It's a major milestone," Stechel says, though the efficiency needs to be improved for the technology to be useful to industry. For context, a Boeing 747 passenger jet burns around 19,000 liters of fuel during takeoff and the ascent to cruising altitude. Recovering heat unused by the system and improving the ceria's heat absorption could boost the tower's efficiency to more than 20 percent, making it economically practical, the researchers say.

Reference

https://www.sciencenews.org/article/jet-fuel-sunlight-air-water-vapor-solar-kerosene

Article by
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Ink Filled With Secret Molecules Can Hide Encryption Key in a Letter

Ink containing encrypted data (left) was used to write this letter (right)

Ink containing polymers that can store data has been used to write a letter containing a hidden message – the encryption key to unlock a text file of L. Frank Baum's The Wonderful Wizard of Oz.

Eric Anslyn at the University of Texas at Austin and his colleagues have developed a technique that involves steganography – the practice of hiding one message inside another. The team generated a 256-character cipher key to encrypt and decrypt files using the Advanced Encryption Standard (AES), a common cryptography method. The group then encoded the cipher key into eight oligourethanes, a type of polymer.

"Because they're a polymer with a very specific sequence, the units along that sequence can carry a sequence of information, just like any sentence carries information in the sequence of letters," says Anslyn.

Each polymer was made up of 10 smaller compounds called monomers. The middle eight monomers hold the details of the key, with one monomer on each side acting as the key's synthesizer and decoder.

The team mixed the polymers with isopropanol, glycerol and soot to make an ink. Using the ink, some of the researchers wrote a letter and then sent it to another person on the team. The group then extracted a sample of the ink and used the cipher key to unlock an encrypted file: the entire text of the novel The Wonderful Wizard of Oz by L. Frank Baum.

"The idea of writing a message but the real, hidden message is contained in the molecular structure of the ink is fascinating, although maybe not the most practical method," says Alan Woodward at the University of Surrey, UK.

For Anslyn, the ability to hide information is secondary. His main

goal is storing data. The information density within molecules in polymers, which include DNA, is higher than it would be through encoded magnetic spots on a hard disc. "The information density is mind-boggling," he says.

Reference

Journal reference: ACS Central Science,DOI: 10.1021/10.1021/acscentsci.2c00460

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Evaluations of Shortest Path Algorithms

THE shortest path problem is a problem of finding the shortest path or route from a starting point to a final destination. Generally, in order to represent the shortest path problem we use graphs. A graph is a mathematical abstract object, which contains sets of vertices and edges. Edges connect pairs of vertices. Along the edges of a graph it is possible to walk by moving from one vertex to other vertices. Depending on whether or not one can walk along the edges by both sides or by only one side determines if the graph is a directed graph or an undirected graph. In addition, lengths of edges are often called weights, and the weights are normally used for calculating the shortest path from one point to another point. In the real world it is possible to apply the graph theory to different types of scenarios. For example, in order to represent a map we can use a graph, where vertices represent cities and edges represent routes that connect the cities. If routes are one-way then the graph will be directed; otherwise, it will be undirected. There exist different types of algorithms that solve the shortest path problem. However, only several of the most popular conventional shortest path algorithms along with one that uses genetic algorithm are going to be discussed in this paper, and they are as follows:

1. Dijkstra's Algorithm

2. Floyd-Warshall Algorithm

3. Bellman-Ford Algorithm

4. Genetic Algorithm (GA)

Over the past 10 years, there has been vast improvement in hardware architecture design for computer information, one of the most important functions being network analysis. The main problem with network analysis is the shortest path analysis. According to the network being analyzed, the shortest path has a variety of measurements, such as time, to find the path. The problem with determining the shortest path, however, is to find both the fastest and the shortest path. Thus, research in the shortest path always has been a point of interest in graph theory. Frequently, graphs are used along with modern technology in such setting as online social networks (e.g., LinkedIn™ or Facebook). Since the size of the graphs is increasing exponentially, many direct processes become more demanding. For example, LinkedIn—a well-known website for professional networking—that tries to connect professionals together worldwide. If a person is trying to get in touch with someone from the human resource department in a company by using LinkedIn, what the website does is try to find the shortest path to reach that person in that specific company, starting from his connections and moving on to friends of friend to reach the desired personal in the specified company. Similarly, this application of the shortest path can be used over and over in different scenarios, for example, finding routes from one point to another point in GPS navigation system. In many cases, when finding the shortest path, in a selected graph that consists of millions of nodes and edges the measurability and accuracy becomes

more complex to measure, the shortest path query must respond to the request as fast as possible with high accuracy. Although the graph may comprise of a lot of nodes and edges but the shortest path must be calculated fast, as an example in car navigation (GPS) an alternative route could be used [1] to provide the driver with a driving route to the requested destination in a given situation the driver would prefer a quick response that is accurate to make right decisions while driving thus a much faster response time is a necessity in this case.

Shortest distances have been used as an underlying metric in a number of measures, such as centrality. One of these measures is betweenness, which is equal to the number of shortest paths between others that pass through a node. The Dijkstra's algorithm selects a source node and loads in the dist[] array with the shortest path distances from s. All the distances that are initialized to infinity, except for dist[s], which are set to 0. Then, s is added to the queue, and the same process continues as for BFS: remove the first node x, and scan all of its neighbouring node, y. Then the new distance to y is computed, and if it is better than the currently known distance, it is updated. Computing the shortest path on large graphs might be a problematic choice as the use of the standard Dijkstra's algorithm to calculate the shortest path between two nodes in a graph has the asymptotic runtime complexity of $0(m + n\log (n))$, where n is the number of nodes and m is the number of edges. Compared to the standard approach which detect the overall path structure in a network by traversing through all the nodes our

proposed algorithm that will only traverse through the bounded path after computing maximal similarity clique (MSC) proposed later in this paper and by doing so making it require less time and search space. Measuring complexity in such approaches is important as it shows how it would perform as the input size grows. Dijkstra's method is one of the well-known algorithms, and that have been used and implemented in several applications and in several approaches. In this study, a benchmark dataset was tested from UNC The Odum Institue, Where we used the data source from there Dataverse Network, the input dataset consists of a collection of XML files Extensible Markup Language, using the standard implementation and just trying to run such dataset or even larger set of data affects the running time as well as might affect the decision making process in case of a real-time necessity. Due to several computation nodes that maybe irrelevant. As a result of this delay in responding which might not be acceptable in some programs or some other cases. The main reason for this delay in Dijkstra's algorithm is that it has to build and keep the shortest path to all nodes in the graph whose distance to the source or main node is less than the distance from the source node to the final node or the destination node. Thus in such a case the consumption of memory by this classical algorithm "Dijkstra's algorithm" is excessive and too demanding to maintain a large amount in the memory as it's a large network that consist of millions of nodes it's absurd and costly for parallel execution of all these queries. The computed time complexity for each of the Dijkstra's, Floyd-Warshall and Bellman-Ford

algorithms show that these algorithms are acceptable in terms of their overall performance in solving the shortest path problem. All of these algorithms produce only one solution. However, the main advantage of GA over these algorithms is that it may produce a number of different optimal solutions since the result can differ every time the GA is executed. In the future, the proposed GA framework will be extended and improved in finding the shortest path or distance between two places in a map that represents any types of networks. In addition, other artificial intelligence techniques such as fuzzy logic and neural networks can also be implemented in improving existing shortest path algorithms in order to make them more intelligent and more efficient.

C. Xi, F. Qi, and L. Wei, ―A New Shortest Path Algorithm based on Heuristic Strategy,‖ Proc. of the 6th World Congress on Intelligent Control and Automation, Vol. 1, pp. 2531–2536, 2006.

Reference

https://TheShortestPathAlgorithams.com

https://journalofbigdata.springeropen.com

Article By
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Importance of Tax Planning

Concept of Tax planning

Tax planning involves intelligent application of various provisions of income tax laws in such a manner to reduce tax liability. Up to date knowledge is pre requisite of tax planning technique. It aims at reduce tax impact on assessee by taking full advantages of deduction, exemption, concession, rebates & reliefs or benefits provided under the Act.

Methods of reducing taxes:

Tax planning, tax avoidance & tax evasion are used to reduce tax liability. But the first one is supported by the act and other two are illegal or unethical as it manipulates provision of law.

Tax planning in respect of salary income -

The scope for tax planning in respect of salary is very limited. The definition of salary is very wide & includes not only monetary salary but also benefits and perquisite in kind. The only deductions available in respect of salary income are standard deduction up to Rs. 50,000/-, deduction for entertainment allowance and deduction for profession tax. While finalising tax liability both option new tax regime and old tax regime provision should be consider to decide which option is more beneficial to the assesse. This decision can be varies from one assessee to another assessee depending upon salary structure, investment & other deduction benefits. Individual can take benefits of deduction under chapter VIA.

let's take an example

Mr. A , aged 32 years is employed with XYZ PVT LTD. On a basic salary of Rs.50000pm. He has received transport allowance of Rs. 15000 pm & House rent allowance of Rs. 20000pm from the company for the P.Y.2021 -22. He has paid rent of Rs.25000pm for an accommodation in Delhi. Mr. A has paid interest of Rs. 210000/- for housing loan taken for the construction of his house in Pune. The construction of house is completed in March 2022 & the house is vacant.

Other information

Contribution to PPF - Rs. 150000/-

Contribution to Pension scheme referred to sec. 80CCD - Rs. 50000/-

Payment of medical insurance premium for father, who is of the age of 65 years - Rs. 55000/-

Payment of medical insurance premium for self & spouse Rs. 32000/-

Compute total income & tax liability of Mr. A for the A.Y. 2022 -23.

(SECONDARY SOURCE)

OPTION - I - REGULAR SLAB STRUCTURE

COMPUTATION OF TOTAL INCOME & TAX LIABILITY OF MR.A FOR A.Y.2022-23

Particulars	amount	amount	amount
income from salary			
basic salary (50000*12)		600000	
transport allowance (15000*12)		180000	
house rent allowance received	240000		
less : exempt u/s 10(13a) working note – 1	240000	0	
gross salary		780000	
less : standard deduction		50000	
income taxable under head salary			730000
income from house property			
nav (self occupied property nav is nil)		Nil	
less: deduction u/s 24(b)		200000	
loss from house property			- 200000
gross total income			530000
less : deduction u/s 80c			
contribution to ppf	150000		
less : deduction u/s 80ccd(1b)			
own contribution to pension scheme	50000	200000	
less : deduction u/s 80d			
medical insurance premium			
for self & spouse	25000		
for father (senior citizen)	50000	75000	275000
net taxable income			**255000**
tax liability			
tax @ 5% on (255000-250000)			250
less: rebate			250
tax liability			**0**

Reference -

https://resource.cdn.icai.org/67697bos54349-cp14.pdf

Article By

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Department Of Commerce

Why Do Onions Make You Cry?

Onions are the third-largest fresh vegetable industry in the United States. Whether chopped, sautéed, or deep-fried, onions find their way into everything from omelets to soup. But slicing and dicing these delectable bulbs often results in tears and a runny nose, even if most cooks agree that the end result is worth it. The tears you shed while chopping onions are not caused by any type of emotion. They're reflex tears stimulated by exposure to irritants. Before you cook another stir-fry, read on to learn why onions make you cry and how to avoid the tears that come with preparing this popular kitchen staple.

WHY DO ONIONS MAKE YOU CRY?

Onions are bulbs that mature underground. The onions' subterranean home is inhabited by creatures such as voles, who love to nibble on roots, tubers, and bulbs. To stop this from happening, onions are equipped with a defense mechanism designed to protect them as they grow from hungry animals. Onions spew enzymes and sulfenic acid when their skin is broken. These compounds combine to produce propanethial S-oxide, an irritating gas. Propanethial S-oxide is a lachrymatory agent, meaning that it generates tears when it touches the eye. Propanethial S-oxide turns into sulphuric acid when it touches the water layer that covers and protects your eyeballs. But just like onions, your eyes are also equipped with a defense mechanism meant to protect them from harm. When the nerves in each eye detect a lachrymatory agent, they generate tears to flush it out. Some people are more likely to cry when cutting onions than others. If you're sensitive or allergic to onions or other alliums, your reaction may be more severe or include symptoms such as hives, itching, tingling.

DOES THE TYPE OF ONION MATTER?

There are many different types of onion, including some that produce fewer tears. The onions that generate the harshest chemical reaction have lots of sulphur-containing compounds. These include yellow, red, and white onions. Sweeter types, such as green onions, have less sulphur, are less pungent, and produce fewer tears in most people. Through genetic transformation, crop scientists have also created tear-free onion varieties. While not yet mass-produced, you can find tear-free onions called Sunions in some specialty markets.

WHAT ARE SOME HOME REMEDIES FOR ONION TEARS?

As much as they may sting, onions are merely annoying and not dangerous to your eyes. Even so, you'll want to treat irritated, burning eyes quickly to eliminate redness and reduce discomfort. Here are some tips to reduce crying from onion irritation:

☐ Put distance or a barrier between yourself and the raw onion you're cutting. Put the sliced onions under glass or elongate your workstation.

☐ Rinse your eyes with cool, clean water.

☐ Place a cool compress or cool cucumbers over your eyes to help reduce irritation.

☐ Use lubricating eye drops to flush out the eyes.

☐ Use other sore eye remedies, such as cotton balls soaked with Aloe vera gel and water or sterile castor oil eye drops.

HOW CAN I PREVENT CRYING FROM CUTTING ONIONS?

First, keep in mind that the length of time you store onions affects their potency and tear-producing abilities. Fresher onions are less likely to cause crying than those that

have been stored for an extended period of time. Here are some other tips for preventing crying from cutting onions:

Cut your onions properly:

The way you cut onions may help reduce crying to some extent. Some chefs recommend slicing away from you so that the onion vapour doesn't rise directly into your eyes. However you slice them, try to avoid cutting your onion near the root end. This is the part that contains the highest concentration of sulphuric compounds that can make you cry. Using a sharp knife may also help. The sharper the knife, the less damage is done to the onion, and fewer irritations are released into the air as a result.

Use water:

To reduce or eliminate onion tears, you may have the best luck if you diminish the sulphuric acid compounds in the onion itself. To do this, try chilling your onion in a bowl of ice water for 30 minutes before cutting. Some people also prefer to cut their onions while submerged in cold water. Just be aware that they'll spit and sizzle wildly in a frying pan if you throw them into oil while wet. Other people find that their eyes get less irritated if they run water while they're cutting onions.

Protect yourself from vapours:

Try running a fan to circulate the air or wearing eye protection, such as goggles while you prepare onions. Working under a cooking hood, which supplies ventilation, may also help. One old tale says to keep a piece of white bread in your mouth while cutting, based on the theory that the bread will absorb onion vapour. There's no evidence for this, but it's worth a shot.

WHAT ARE SOME ALTERNATIVES TO ONIONS?

The distinctive taste of fresh onion can be hard to replicate. But you may want to substitute onions in your cooking if they frequently cause uncomfortable, disruptive eye symptoms. Here are several alternatives and other ingredients you can try:

☐ Use pre-cut onions, which are available both fresh and frozen.

☐ Use dried onion or onion powder.

☐ Opt for another allium that doesn't cause crying, such as garlic, shallots, scallions, leeks, or chives.

☐ Replace the crunch of onion with radishes or celery in salads.

☐ Cook with fennel, which provides a velvety, liquorice taste, instead of caramelizing onions.

THE TAKEAWAY

Preparing onions often causes a chemical reaction those results in tears for most people. Some people are more sensitive to onions than others. Try chilling onions in ice before cutting to help reduce their sting. White, yellow, or red onions are also more likely to make you cry than green ones. Sweeter onions are gentler on the eyes than those with a more pungent taste.

References:

https://www.healthline.com/health/why-do-onions-make-you-cry
https://phys.org/news/2017-08-nitty-gritty-onions.html

Article by
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Light from Space Has Record-Breaking Energy

Twelve gamma ray hot spots suggest our galaxy harbors powerful particle accelerators

Extremely energetic light from space is an unexplained wonder. Scientists don't know where that light comes from, exactly and now astronomers have spotted these light, called gamma rays, at higher energies than ever before.

You can't see gamma rays with your eyes. They are much more energetic than the light that we can see. So you need a fancy detector to spot them. The Large High Altitude Air Shower Observatory, LHAASO, is an experiment in China. It searches for extremely high energy gamma rays.

HASSO spotted more than 530 of these brilliant rays with more than 0.1 quadrillion electron volts of energy. The highest-energy of these gamma rays was about 1.4 quadrillion electron volts. That's a lot. And it's the highest-energy light ever seen.

Previously, the most energetic gamma ray known had less than a quadrillion electron volts.

For comparison, the super-energetic protons in the largest particle accelerator on Earth — the Large Hadron Collider — only reach trillions of electron volts.

Those hot spots hint that our galaxy, the Milky Way, has powerful particle accelerators. But those particle accelerators aren't made by humans. Instead, they come from violent events in the cosmos. They might be exploding stars, for example. Such violent events make electric and magnetic fields. Those can speed up protons and electrons. Those fast particles can then produce gamma rays with a lot of energy. That can happen when protons interact with other matter in space, for example.

Scientists aren't sure what could produce gamma rays with the extreme energies observed. But the new observations point to two possibilities. One hot spot was associated with the Crab Nebula. That's the turbulent remains of an exploded star. Another possible source was the Cygnus Cocoon. That's a region where massive stars are forming. The stars blast out intense winds in the process.

LHAASO is located on Haizi Mountain in China's Sichuan province. It is not yet fully operational. It's due to be completed later this year. Then, it could find even more gamma rays

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Facts in Sea Snakes

Sea snakes, are the reptiles that inhabit marine environments for most or all of their lives. Sea snakes are extensively adapted to a fully aquatic life and are unable to move on land, except for the sea kraits, which have limited land movement. Sea snakes found in coastal waters and as well as to the deeper waters. As they are free swimming, all sea snakes have paddle-like tails and many have laterally compressed bodies. They do not have gills and hence they need to come to the surface regularly to breathe. Some snake species are possess potent venoms. Some have gentle dispositions and bite only when provoked, while others are much more defensive.

The majority of adult sea snakes species grow to between 120 and 150 cm (4 and 5 ft) in length. Their eyes are relatively small with a round pupil and most have nostrils located dorsally. The skulls do not differ significantly from those of terrestrial elapids, although their dentition is relatively primitive with short fangs. Most sea snakes are completely aquatic and have adapted to sea environments in many ways, the most characteristic of which is a paddle-like tail that has improved their swimming ability. Their Ventral scales are reduced in size or may be absent in some species. Absence of ventral scales indicates that they are virtually helpless on land. They live out their entire lifecycles at sea, they have no need to leave the water. Snake's tongue fulling its obligatory function under water. Its action is short compared to that of terrestrial snake species. The nostrils have valves consisting of a specialized spongy tissue to exclude water, and the windpipe can be drawn up to where the short nasal passage opens into the roof of the mouth. This is an important adaptation for an animal that must surface to breathe. Their lungs has become very large and extends almost the entire length of the body, although the rear portion is thought to have developed to aid buoyancy rather than to exchange gases. The extended lung possibly also serves to store air for dives.

Scalation among sea snakes is highly variable. Relatively little is known about sea snake vision.

Despite their marine adaptations, most sea snakes prefer shallow waters near land, around islands, and especially somewhat sheltered waters, as well as near estuaries. Sea snakes are generally reluctant to bite and are usually considered to be mild-tempered, although variation is seen among species and individuals. Some species which

feed by simply gulping down their prey, are more likely to bite when provoked because they seem to use their venom more for defence. Others, use their venom for prey immobilization.

Sea snakes are often handled without concern by local fishermen who unravel and toss them back into the water barehanded, usually without getting bitten, when the snakes frequently become entangled in fishing nets. Species reported as much more aggressive.

On land, their movements become very erratic. They crawl awkwardly in these situations and can become quite aggressive, striking wildly at anything that moves, although they are unable to coil and strike in the manner of terrestrial snakes. Sea snakes appear to be active both day and night. Sea snakes have been sighted in huge numbers. They feed on small fish and occasionally young octopus. They are often associated with the sea snake barnacles, which attaches to their skin.

Except for a single genus, all sea snakes are ovoviviparous. The young are born alive in the water where they live their entire lives. In some species, the young are quite large, up to half as long as the mother. The one exception is the genus Laticauda, which is oviparous.

The majority of the sea snakes are highly venomous. The majority of the sea snakes are highly venomous. But rarely inject it when biting.

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