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Sample calculations for applications in science and information technology

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Problem (1 / 3)

A biochemistry research laboratory reported a smell akin to eggs in the cooling fluid of a specialized chromatography equipment. An aliquot sample of the cooling fluid was tested by a certified outside analytical laboratory to determine both the qualitative and quantitative composition.

After an elemental analysis using a chain of custody form for the aliquot sample , several chemist at the outside firm unearth 4000 ug /L of Hydrogen Sulfide and a pH of 7. 25

a.

If the Sulfur is due to only a sulfur bacteria breaking down organic matter in the cooling fluid, Calculate Parts per Million, Parts per Billion , Pounds per Gallon , and Molarity of Hydrogen Sulfide in the aliquot sample. Molarity = Moles / L

b.

With the Henderson-Hasselbalch Equation , calculate the ratio of base to acid if the pH and the pKA are equal. $pH = pKa + \text{Log}\ [\ \text{Base}/\ \text{Acid}\ ]$, $pH + pOH = 14$

Problem (2 / 3)

A fortune 500 company with expert knowledge of Lean Six Sigma Methods manufactures then sells about 10 million vehicles per year. In order to reduce the cost of networking events, the company did benefit cost analysis then procured a fleet of Bertram 91 Yachts.

The purpose of the Lean Six Sigma networking events is to encourage brainstorming of incremental but consistent improvements in the make to order production based on actual demand called the Pull. A second motivation is to not just reduce but eliminate any residual remaining stock up inventory for delivery which might never occur called the Push.

Since scientific research provided enough evidence to prove such brainstorming events are not statistically insignificant, The Bertram 91 Yachts are used to encourage networking among engineers , scientist , plant management , suppliers , wholesale dealers, and executive management to reduce the waste of vital resources.

Strategically , the company keeps at least one yacht in Saratoga in New York, Miami in Florida , Gustavia in Saint Barthelemy , and Charlotte Amalie in The United States Virgin Islands .

c.

If the top speed for The Bertram 91 Yachts are 34 knots per hour , what is the travel time in The Caribbean Sea for the yacht in Gustavia to join the yacht in Charlotte Amalie if a workaround is need for a larger than expected Lean Six Sigma networking event .
The distance between St. Barthelemy and Charlotte Amalie is 224.45 kM. Plus , one statute mile is 1.15 nautical mile . One mile is about 5280 feet. One cM = 2.54 inches.

d.

If the company procures a new Bertram 91 Yacht for actual current demands for The Saratoga fleet, what is the ground transportation travel time for the new yacht to arrive in New York from Tampa Florida. Total distance is 2 116 Kilometers.

The company will only secure a contractor with at least two experienced commercial drivers plus four experienced non-commercial drivers for two pilot vehicles. Since no heavy haul is allowed after dark, the engineers only allow 16 hours of operation per day. Also, the engineers allow no more than 65 miles per hour for all oversize hauls.

Problem (3 /3)

The information technology branch of an organization which manufactures commercial turbine aircraft engines, electrical power systems , landing gear, braking systems , and flight control systems needs new function calls to produce different colors for an improved GPS navigations system.

To avoid compatibility issues with the operating systems when allowing both the old versions and the new versions of the GPS software to run on the aircraft GPS navigations system, the information technology branch considers the adverse risk associated with the CPU, Universal Serial Bus, and the motherboard.

a.

To reduce the above adverse risk , the management decided the binary digit 00011010 will be used to call the function for yellow. After that , the binary digit 00001100 was assigned to blue. what is the binary digit to call the function for green ?

b.

If the binary digit 00011010 will be used to call the function for yellow and if the binary digit for red is 00111110 , what is the binary digit to call the function for orange ?

c.

With the everyday normal base 10, express 6357 using exponents ?

d

Binary digits are used in computer circuits , what is the binary 1011 in the normal base 10 ?

e

Since only binary digits are used in computer circuits , calculate the items below.

1	11	110	0011
+ 1	+ 10	+ 011	+ 1110
_____	_____	_____	_____