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MATHEMATICAL MODELLING

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ABSTRACT

Mathematical modelling is a process to represent real world problem in mathematical terms and it solved by using different known tech. by analyze the model , think over the possible outcomes with reality. Also it begins with the situation and formulate it completly in a manner to better understand the original situation.

I. INTRODUCTION

1. The human hearts pump 5 to 6 liters blood in the body every 60 seconds. How we come to this conclusion ?
2. The temperature at the surface of the sun is about 6000°c. How we can guess it ?
3. How we can find number of Fishes in a large pond?
4. To find the distance between sun and earth ?
5. To estimate the effect of Global warming .
6. To find mass of earth and other planets .
7. To estimate the veins and arteries a human body have .
8. To estimate the population of a country.
9. To estimate the stars in the sky .

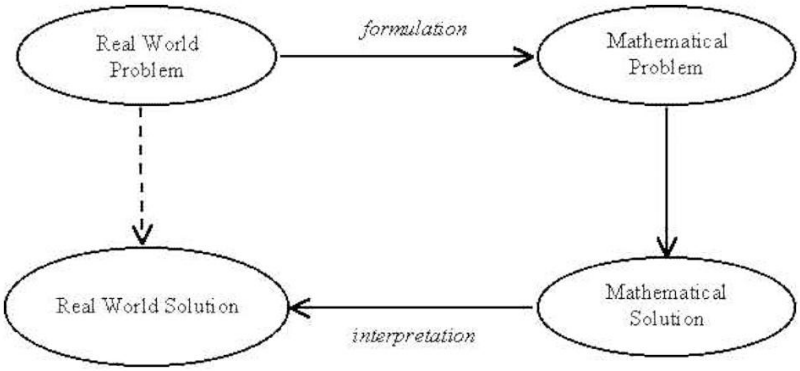
Did all results estimated by pulling out veins and arteries ,travelled to sun with thermometer ,jumped into the rivers for counting living things inside it ,counted all stars ? surely not.well all answers lie in mathematical modelling .

II. MATHEMATICAL MODELLING

Mathematics is often called "the language of the universe".

With mathematics, we can describe and make predictions about the behaviour of things around us. The results are often better than ever expected — in fact, one mathematician even wrote an essay about what he called the "unreasonable effectiveness" of mathematics in solving physical problems! This power to describe a complicated system in a simple way is useful in many different branches of study.

Mathematical modelling is a process of representing real world problems in mathematical terms which are solved by using diff. known tech. by any. the model ,think over the possible outcomes with reality .Also it begans with the situation and formulate it completely in a manner to better understand the original situation to find solutions to the problems.



Stages in Mathematical modelling

Understanding the problem:- Define the real problem dicuss the issues that wish to understand simplify by making assumptions and ignoring some factors so that problem is manageable

Formulating the mathematical model:- Define the variable and write the equations and inequalities and gather all the data into tables than make the graph for following possibilities and calculate .

Solving the mathematical problem:- solved the problem by using various mathematical techniques

Interpreting in the real life situation:- Solution obtained by mathematical problem and compare it in the context of the real life situation

Validating of model:- Go back to original solution and see if the result of mathematical work make sense otherwise new information or assumptions assumed.

Example:- If we rolling a pair of dice what number would be the best guess?

Solution1. A few no. which have higher chance

Solution2. Define a model that shows that the dice has a random choice one of the following 36 pairs of no.

(1,1) (1,2) (1,3) (1,4) (1,5) (1,6) (2,1) (2,2) (2,3) (2,4) (2,5) (2,6) (3,1) (3,2) (3,3) (3,4) (3,5) (3,6) (4,1) (4,2) (4,3) (4,4) (4,5) (4,6) (5,1) (5,2) (5,3) (5,4) (5,5) (5,6) (6,1) (6,2) (6,3) (6,4) (6,5) (6,6)

SUM	2	3	4	5	6	7	8	9	10	11	12
P	1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36

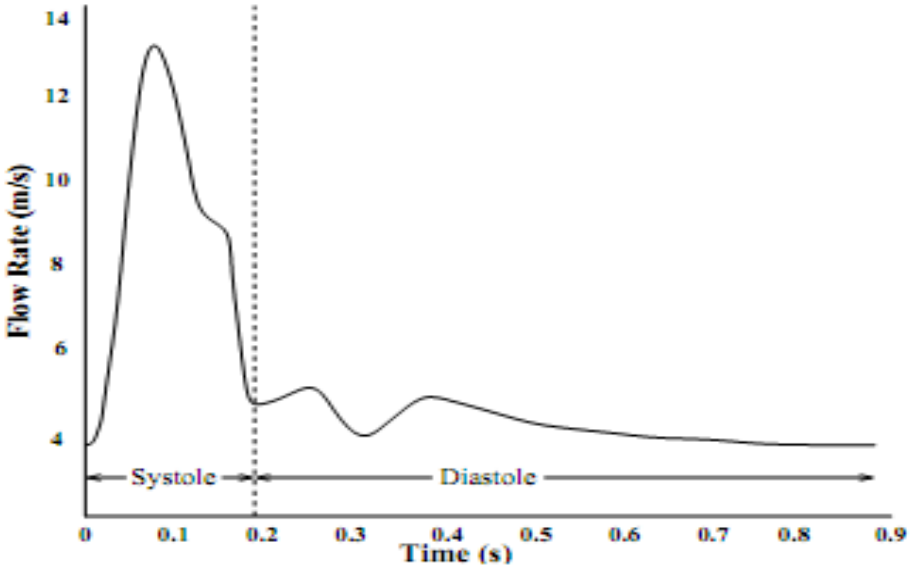
4. Possibility of getting the sum 7 is highest.

5. Now toss a pair of dice a large no. of times and compare it with its solution in mathematical terms.

Uses of mathematical modelling in various fields: In games changes make to athletes equipments and clothes only make difference to their performance In toys such as dice, rubick (scrambled cube solved in a maximum twenty six steps)

III. BIO PHYSICS

In bio physics a major feature of blood flow is represented by its pulsalility with some approximation one may think the blood flow to be periodic in time.Yet this is usally true only for relatively short periods,since the various human activities require to change the amount of blood sent to various organs.the cardiac cycle features two phases systolic phase and diastolic phase.



Flow Rate in an Artery During Cardiac Cycle

IV. QUADRATIC EQUATION

If you throw a ball or stone, it will go up into the air, slowing down as it goes, then come down again ...

and a Quadratic Equation tells you where it will be

A ball is thrown straight up, from 4 m above the ground, with a velocity of 15 m/s. When does it hit the ground?

$h = 4 + 15t - 5t^2$

$4 + 15t - 5t^2 = 0$

The "t = -0.2" is a negative time, impossible in our case.

The "t = 3" is the answer we want:

Ball hits the ground after 3 seconds

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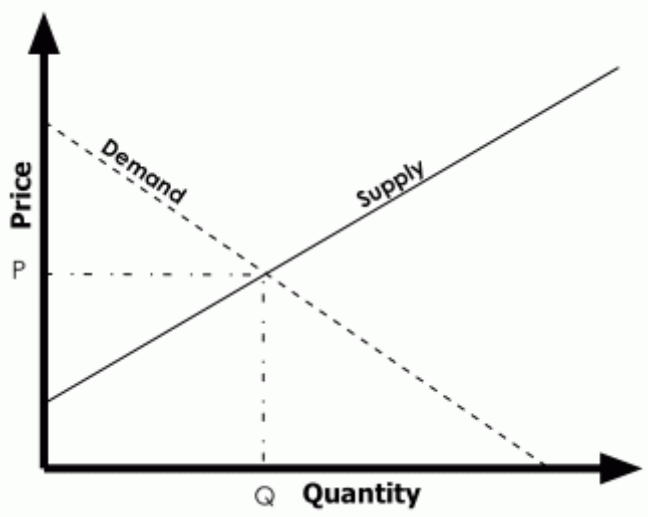
V. CHEMISTRY

- Assume that a gas is heated in a sealed flexible container so the pressure remains constant ($P=P_o$) and you want to develop a mathematical model describing how the volume of the container changes with time.
- Heater power is constant and is inside the container so the gas begins heating up immediately.
- The gas mixes rapidly so that it heats uniformly

5.1 Economics

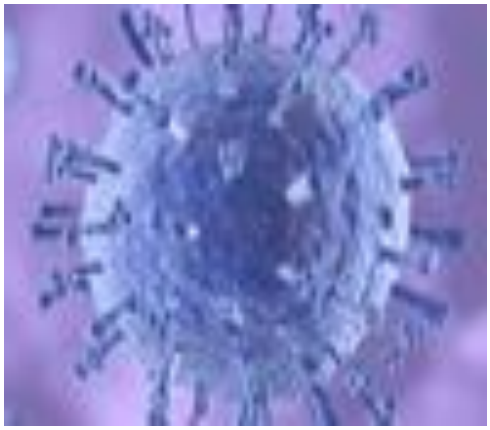
Role of demand and supply in the determination of the price of commodity



Financial managers, property,real estate, purchasing managers,buyers, Purchasing agent accountant, auditors, budget analysts, insurance agents ,top executives.

5.2 Medicine and Nature

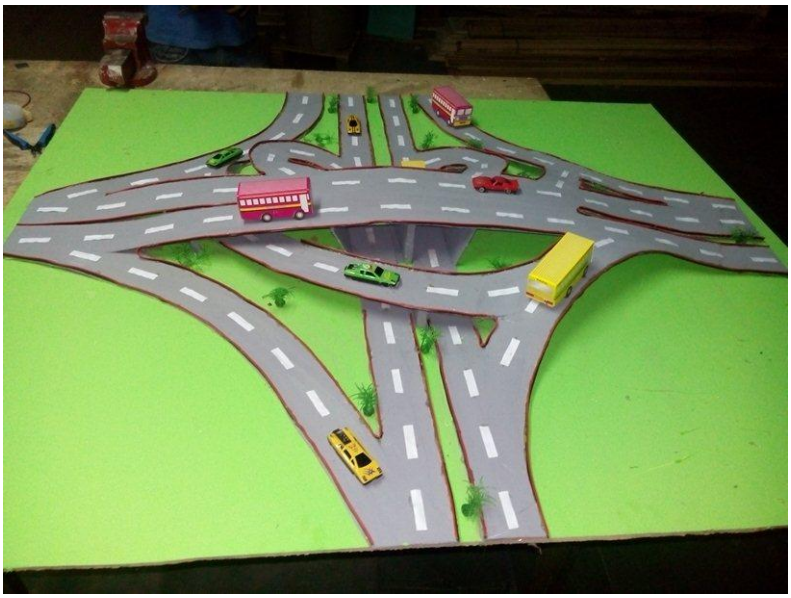
- How an infectious disease spread.?
- The Arctic ice cap is melting fast (Mathematical modelling is key to predicting how much longer the ice will be around and assessing the impact of an ice free Arctic on the rest of the planet).
- Counting calories
- Met office forecaster
- Prediction of volcanic eruptions and earthquakes.
- Prepare Impact of natural disaster.



5.3 The Mathematical Modelling in Civil Engineering (MMCE)

MMCE addresses both theoretical developments and practical applications related to Civil and Structural Engineering, Earth and Environmental Science, Engineering Thermodynamics, Transport Phenomena, Structural Foundations, Hydraulic Engineering fields.



5.4 Uses of Mathematical Modelling in other Various fields Artificial intelligence

- Computer vision
- Image interpretation
- Robotics
- Speech recognition
- Optical character recognition
- Reasoning under uncertainty

5.4.1 Arts

- Computer animation (Jurassic Park)

5.4.2 Astronomy

- Detection of planetary systems
- Correcting the Hubble telescope
- Origin of the universe
- Evolution of stars

5.4.3 Chemical engineering

- Chemical equilibrium
- Planning of production units

5.4.4 Computer science

- Image processing
- Realistic computer graphics (ray tracing)

5.4.5 Criminalist science

- Finger print recognition
- Face recognition

5.4.6 Electrical engineering

- Stability of electric circuits
- Microchip analysis
- Power supply network optimization

5.4.7 Fluid mechanics

- Wind channel
- Turbulence

5.4.8 Geosciences

- Prediction of oil or ore deposits
- Map production
- Earth quake prediction

5.4.9 Internet

- Web search
- Optimal routing

5.4.10 Linguistics

- Automatic translation

5.4.11 Materials Science

- Microchip production
- Microstructures
- Semiconductor modelling

5.4.12 Mechanical engineering

- Stability of structures (high rise buildings, bridges, air planes)
- Structural optimization
- Crash simulation

5.4.13 Physics

- Elementary particle tracking
- Quantum field theory predictions (baryon spectrum)
- Laser dynamics

5.4.14 Political Sciences

- Analysis of elections

5.4.15 Psychology

- Formalizing diaries of therapy sessions

5.4.16 Space Sciences

- Trajectory planning
- Flight simulation
- Shuttle re-entry

5.4.17 Transport Science

- Air traffic scheduling
- Taxi for handicapped people
- Automatic pilot for cars and airplanes

VI. LIMITATIONS

1. The formulation of mathematical model depends upon the psychology of perception of the mathematician/scientist. Things which are to be included or ignored are of great importance.

For instance population growth depends upon some of the following factors:

- A diseases like plague, which destroyed population on mass scale a few decades ago.
- A natural calamity like earthquake, Tsunami etc.
- Decrease in death rate due to increased life expectancy.

2. The model cannot create a mathematical solution to a problem that doesn't lend itself to a mathematical model. For example the emotions, behavior etc.

- The results are too technical to communicate.
- The results aren't in a form that can be implemented.
- Resources aren't adequate to implement a suggested solution.

Therefore, the success of modeling depends on the parameters which are taken into account by the modeler which are to ignored and which are to be retained?

References: Net search

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