SOFT COMPUTING

Q1) What is computing?

(Ans.) The discipline of computing is the systematic study of algorithmic processes that describe & transform information: their theory, analysis, design, efficiency, implementation & application. There are two types of computing – Hard Computing & Soft Computing.

Q2) What is soft computing?

(Ans.) Soft Computing is the use of approximate calculations to provide imprecise but usable sol^n to complex computational problems. The approach enables sol^n for problems that may be either unsolvable or just too time-consuming to solve with current hardware. Soft Computing is sometimes referred to as computational intelligence. It provides an approach to problem solving using means other than computers. With the human mind as a role model, soft computing is tolerant of partial truths, uncertainty, imprecision and approximation, unlike traditional computing models.

Q3) What is hard computing?

(Ans.) Hard Computing i.e, conventional computing, requires a precisely stated analytical model and often a lot of computation time. Many analytical models are valid for ideal cases, but real world problems exist in a non-ideal environment. The premises and guiding principles of hard computing are precision, certainty and rigor.

Q4. Compare b/w soft and hard computing.

(Ans.)

Soft Computing	Hard Computing
i) Deals with assumptions.	i) Deals with precise values.
ii) Accuracy is not necessary.	ii) Accurate output is needed.
iii) Useful for routine, control, decision making tasks.	iii) Useful in critical systems.
iv) Its a liberal of inexactness, uncertainty, partial truth and approximation.	iv) Needs an exactly stated analytical model.
v) Relies on formal logic and probabilistic reasoning.	v) Relies on binary logic and crisp system.
vi) Stochastic in nature.	vi) Deterministic in nature.
vii) Works on ambiguous & noisy data.	vii) Works on exact data.
viii) Can perform parallel computations.	viii) Performs sequential computations.
ix) Produces approximate results.	ix) Produces precise results.
x) Emerges its own program.	x) Requires programs to be written.
xi) Incorporates randomness.	xi) Is settled.
xii) Uses multivalued logic.	xii) Uses two-valued logic.

Q5. Define the premises of Soft Computing.

(Ans.) Premises of soft computing:

i) The real world problems are pervasively imprecise and uncertain in nature. And the conventional approach banks on precisely stated analytical models and are mostly valid for ideal cases only.

ii) Precision & certainty carry a cost.

Q6) Define the principles of soft computing.

(Ans) The Basic principle of soft computing is to exploit the tolerance for imprecision, uncertainty, partial truth and approximation to achieve tractability, robustness and low solution cost.

Q7) What are the implications of soft computing?

(Ans) Soft Computing employs Neural Networks, Fuzzy logic, etc. in a complementary manner rather than a competitive way. One example of a particularly effective combination is what has come to be known as "neurofuzzy systems", which is a culmination of neural network and fuzzy logic systems. Such kind of systems are becoming increasingly visible as consumer products ranging from air conditioners and washing machines to photocopiers and camcorders are all using them; along with many more industrial applications.

Q8) What are the unique properties of soft computing?

(Ans) i) learning from experimental data.
ii) Soft computing techniques derive their power of generalization from approximating or interpolating to produce outputs from previously unseen inputs by using outputs from previously learned inputs.
iii) Generalization is usually done in a high dimensional space.

Q9) Briefly define 4 techniques of Soft Computing.

(Ans) The 4 techniques of Soft Computing are:

i) NEURAL NETWORK:
A Neural Network is a system composed of many simple processing elements operating parallely, whose function is determined by network structure and connection strengths, while the processing is performed at computing elements or nodes. The knowledge is acquired by the network through a learning process. And the inter neuron connection strengths, known as synaptic weights, are used to store intelligent this knowledge. Thus mimicing brain mechanisms to emulate behaviour.

ii) SUPPORT VECTOR MACHINE (SVM):
SVM is a classifier derived from statistical learning theory. It is a learning machine that uses data to find the approximating function (in regression problems) or the separation boundary (in classification or patter recognition problem) in high dimensional situations.

iii) GENETIC ALGORITHM:
Genetic Algorithm is a search heuristic that is inspired by Charles Darwin's theory of natural evolution. This algo reflects the process of natural selection where the fittest individuals are selected for reproduction in order to produce offspring of the next generation. It is particularly well suited for hard problems where little is known about the underlying search space.

iv) **FUZZY LOGIC :**

Fuzzy Logic is an approach to computing based on "degrees of truth" rather than the usual "true (1) or false (0)" Boolean logic, on which the modern computer is based. It is employed to handle the concept of partial truth, where the truth value may range b/w completely true and completely false.

Q 10) Mention the importance of soft computing.

(Ans.) i) It exploits the tolerance of imprecision, approximation and uncertainty to achieve robustness and low cost solution. Infact the role model of soft computing is the human mind.

ii) Here, the participating methodologies are complementary than competitive. It is essentially a partnership among different techniques in which each of the partners contribute a distinct methodology for addressing problems in its domain.

iii) In both consumer products and industrial systems, the employment of soft computing techniques leads to systems which have high Machine Intelligent Quotient (MIQ).

Q 11) What are the different applications of soft computing?

(Ans.) The applications of soft computing are in different fields:

i) Business :
  → Customer Targeting
  → Sequencing
  → Scheduling
  → Fuzzy data analysis
  → Optimizing R&D projects.

ii) Finance:
→ Risk Profile Analysis
→ Insurance Fraud Detection
→ Fuzzy Scoring for Mortgage Applicants
→ Credit worthiness assessment
→ Foreign Exchange Trading

iii) Engineering:
→ Hand writing recognition
→ Image Processing & Data Compression
→ Neuro Fuzzy Systems
→ Fuzzy Logic Control
→ Machine Learning Applications.