English for Computer Science

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Passage 1

Once an error is generated, it will generally propagate through the calculation. This leads to the notion of numerical stability: an algorithm is numerically stable if an error, once it is generated, does not grow too much during the calculation. This is only possible if the problem is well-conditioned, meaning that the solution changes by only a small amount if the problem data are changed by a small amount. Indeed, if a problem is ill-conditioned, then any error in the data will grow a lot.

However, an algorithm that solves a well-conditioned problem may or may not be numerically stable. An art of numerical analysis is to find a stable algorithm for solving a well-posed mathematical problem. A related art is to find stable algorithms for solving ill-posed problems, which generally requires finding a well-posed problem whose solution is close to that of the ill-posed problem and solving this well-posed problem instead.

Passage 1

The algorithms of numerical analysis are routinely applied to solve many problems in science and engineering. Examples are the design of structures like bridges and airplanes, weather forecasting, climate models, the analysis and design of molecules (computational chemistry), and finding oil reservoirs. In fact, almost all supercomputers are continually running numerical analysis algorithms.
As a consequence, efficiency plays an important role and a heuristic method may be preferred above a method with a solid theoretic foundation because it is more efficient. Generally, numerical analysis uses empirical results of computation runs to probe new methods and analyze problems, though it of course also employs mathematical axioms, theorems and proofs.

Passage 1

16- Efficiency plays an important role in the design of numerical algorithms and that is why $\cdots$ may be preferred.

1) a method with solid theoretical foundation
2) a heuristic method
3) an iterative method
4) a direct method

17- A numerically stable algorithm always finds $\cdots$ problem.

1) a good approximation of the solution of an ill-conditioned
2) a poor approximation of the solution of a well-conditioned
3) a good approximation of the solution of a well-conditioned
4) a good approximation of the solution of any

18- A numerical algorithm that finds a highly inaccurate solution of a given problem $\cdots$.

1) is a heuristic algorithm
2) is not stable
3) may be stable or not
4) is stable

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1) solving well-conditioned problems
2) computational experimentation
3) solving ill-conditioned problems
4) merely analytical proofs

20- Supercomputers continuously run numerical algorithms to $\cdots$ problems.

1) establish theorems for application of
2) investigate the conditions of
3) probe new methods and analyze
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21- It is easy to $\cdots$ about what might have happened.

1) theorize 2) overlap 3) reveal 4) decide

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1) investments 2) courses 3) complexities 4) examples

23- Computer Science and $\cdots$ subjects are not taught here.

1) deflationary 2) revealed 3) inflationary 4) analytic

24- In the statement $Y = 2X$, Y is a $\cdots$ of X.

1) function 2) relation 3) transpose 4) rule

25- Is the picture always $\cdots$ on your TV? Is it not clear?

1) fuzzy 2) across 3) broad 4) dum

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Passage 2

Topology is a branch of geometry. Euclidean geometry studies properties of objects that are invariant under rigid motions in Euclidean space. Topology studies geometric properties that are invariant under any continuous deformation. It is sometimes called "rubber-sheet geometry" because the objects can be stretched and contracted like rubber, but cannot be broken. For example, a square can be deformed into a circle without breaking it, but a figure 8 cannot. Hence a square is topologically equivalent to a circle, but different from a figure 8.

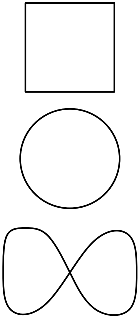

Figure 8

A typical question in topology would be how many holes are there in an object. How can you define the holes in a torus or sphere? What is the boundary of an object? Is a space connected? Does every continuous function from the space to itself have a fixed point?

Passage 2

General topology normally considers local properties of spaces, and is closely related to analysis. It generalizes the concept of continuity to define topological spaces, in which limits of sequences can be considered. Sometimes distances can be defined in these spaces, in which case they are called metric spaces; sometimes no concept of distance makes sense.

Combinatorial topology considers the global property of spaces, built up from a network of vertices, edges and faces. This is the oldest branch of topology, and dates back to Euler. He showed that topologically equivalent spaces have the same numerical invariant, which we now call the Euler characteristic; this is the number $(V - E + F)$, where V, E, and F are the number of vertices, edges and faces of an object. For example, a tetrahedron and a cube are topologically equivalent to a sphere, and any dissection of a sphere will have an Euler characteristic of 2.

Passage 2

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1) related to finding limits of sequences
2) built on properties of squares
3) related to dissection of a sphere
4) relatively old

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1) invariance properties under continuous deformation.
2) geometric formation of space
3) the study of convergent sequences
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