Tareas calificadas por los compañeros: Develop an analogy

Revisar los trabajos de tus compañeros
¡Felicitaciones por enviar tu trabajo! Ahora tus compañeros pueden revisarlo. Para obtener tu calificación, también debes revisar los trabajos de algunos de tus compañeros. Tu calificación debería estar lista antes del **4 de feb. 2:59 -05**.

Revisar tareas

Instrucciones | Mi presentación | Discusiones

Algorithms course

Enviado el 24 de enero de 2021

Enlace para compartir

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1. Choose a science concept you teach which students find difficult. Describe the concept here.

Backtracking is an algorithmic design strategy or paradigm whose main idea is that given a problem, we can build and test candidate solutions (opposed to complete search, a paradigm where all possible solutions are tested and we choose the correct answer after finding it). The building idea consists in creating factible answers step by step and stopping exploration in paths as soon as the solution is no longer factible.

a short example can be the following problem:
-find all subsets of [5, 2, 4] whose sum is 6.

complete search: generate the 2^3=8 subsets, calculate each subset sum and obtain the right answers.

Backtracking:
PATH 1: take 5--> (5<6 try adding another number) --> take 2 (sum is 7 so abandon path)
PATH 1.1: take 5--> (5<6 try adding another number) --> take 4 (sum is 9 so abandon path)
PATH 2: take 2-->(2<6 try adding another number) --> take 4 (sum is 6, so we've found an answer)
Path 3: take 4-->(4<6 abandon path beacause there aren't any other numbers left)

Here we tested 6 subsets [5], [5,2], [5,4], [2], [2,4], [4], remember that using complete search we used 8. The difference here is not huge, but in some problems with high values or big sets of data, efficiency can be dramatically improved using Backtracking

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2. Choose a suitable experience-based source domain (analog/object of comparison) for your analogy. Be sure the source domain is familiar to your students. Describe your analogy in the format: TARGET CONCEPT is SOURCE DOMAIN (e.g. PROTEIN SYNTHESIS is BUILDING A HOUSE.)

BACKTRACKING is COLORING A MAP.

You are coloring a world political map and so far no country is adjacent to another country with the same color, but at some point you discover that you'll have to paint a country with a color already used in one of his neighbors. In this situation beginning again would be very frustrating, so you decide to erase the coloring of the conflicting countries and try to solve it in a proper way choosing a better color asignation.

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3. Describe why this source domain will be familiar to your students.

I think there is a high probability that all or most of the students had at sometime in school the asignment of tracing and coloring a map for their geography class, even if not, maps are well known and understood.

Something i would like to highlight is that the classical example of backtracking used in many books is the chess "8 queens problem", anyway i do not think it to be very engaging.

The map analogy has both conceptual and experience elements, and it is not affected by culture, it is universal.
I think the problem described in the analogy has probably happened to students because, especially when we are kids, it is easier using a lot of colors than using a smart asignation to avoid color repetition in neighbors.

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4. Describe at least three ways the analog and science concept of your analogy match. And identify at least two shortcomings (where the analogy no longer works.)

Likes

1 YOU DON'T LOSE YOUR EFFORT AND DON'T WASTE TIME
Analog: you won't waste time completing a map that already has an error, you need to correct it first.

Science concept: a backtracking algorithm spends computation time only on factible solutions, if a problem is detected that makes a family of solutions wrong, it will go a step back and explore other possible solutions.

2 EXISTENCE OF A CHOICE AT EACH STEP
Analog: At each step you decide which color to use for a given country.
Science concept: at each step you make a "choice". The algorithm will test all possible paths (using all choice options) and it will continue processing each path until it finds a correct solution or it stops exploring because the answer is not factible. We must identify all choice options at each step of the problem.

3 GOOD BUT NOT BEST EFFICIENCY
Analog: While coloring you'll probably make mistakes and have to erase. There is no guarantee that you'll be successfull in your first attempt of choosing colors. Maybe defining a general strategy would be better than coloring step by step and correcting emerging mistakes.
Science concept: The algorithm efficiently explores and finds the correct answer, it doesnt calculate it. It is possible that some problems are easily solved using bucktracking but a different approach can be faster.

UNLIKES

1 AVOID vs DETECT
Analog: You avoid doing mistakes when you identify an emerging mistake. As soon as you detect an emerging mistake you'll consider ways of avoiding it. You'll never color two neighbor countries the same but you'll discover "if i continue this actual asignation i'll have to paint two neighbors the same color". You can reflect ant try to fix problems.
Science concept: Backtracking algorithms usually detect mistaken done choices. The algorithm makes a choice and then checks the new values affected by the decission, if the choice went wrong we undo it.

2 GETTING OR COUNTING SEVERAL SOLUTIONS
Analog: applying backtracking in real life just with paper and no computers to discover not just one but all the possible solutions to asign colors to a map would be slow and exhausting. Some problems can be approached easily using better counting techniques.
Science concept: Backracking is an easy and fast option to discover all solutions to a given problem using computers.

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5. Student learning - How would you know if your analogy will lead to an improved learning outcome for your students?

Before
I think that because of following many of the the ideas of the framework and of the FAR guide in formulating the analogy, understanding is highly probable to succeed.

After
-I would ask my students to write a 2 minute paper about the class, expecting them to explain the learned concepts using the showed or other analogies they like.
-i would give students a practical exercise or problem and then ask randomly what some students did to solve it. I would then solve it and try to solve any doubts or unclear points.

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6. Reflection - How is the teaching you have described in this assignment different from how you usually teach or how you were taught as a student?

When i learned Backtracking at university the professor used the chess queens example to explain the topic. Now i realize that at that time i understood the concept but not the process, the proffessor showed some charts and graphs of recursion trees that ilustrated the concept and also talked about the theory, but anyway i could not understand how to design or code an algorithm using backtracking.

The presented analogy is highly ilustrative of the ideas and way that backtracking works. I think the enumerated similarities and differences help to show many important features of the topic and provide a good basis to initiate a theoretical and more formal approach.

So, to summarize i think the presented teaching would be better because the analogy is seen as a first step to complement with experiences and denoted concepts to achieve learning and also we cared about highlighting the most important features of the scientific concept through the analogy.

Editar envío

Comentarios

Solo el estudiante puede ver comentarios que se dejan para ese estudiante y la persona que dejó el comentario.

JS

Comparte tus ideas...