Edit Games

Daniel Ashlock, University of Guelph

Andrew McEachern, University of Victoria

An 'edit' is a small, simple change in a configuration, such as changing a letter in a word or moving a toothpick in an arrangement of toothpicks. The goal of edit puzzles is to find a sequence of edits (possibly minimal) to change one configuration into another. This article examines various edit puzzles and defines a new type called Number Sentence Morphing. Dynamic programming is useful for solving edit puzzles and assessing their difficulty. We examine examples of the effects of placing additional conditions on the edits. Number Sentence Morphing puzzles can also be useful for elementary math courses, and they are used as an example of how to design an automatic puzzle synthesis system with algorithms based on combinatorial graphs.

1 Introduction

A N *edit puzzle* is one in which the solver must change one configuration into another by a series of moves. A *move* in such puzzles is a minimal change, called an *edit*. A classic example of this is given in Figure 1, taken from the Toothpick Geometry website.[1] Starting with a configuration of four 1×1 squares, the goal is to remove two toothpicks and leave only two squares.
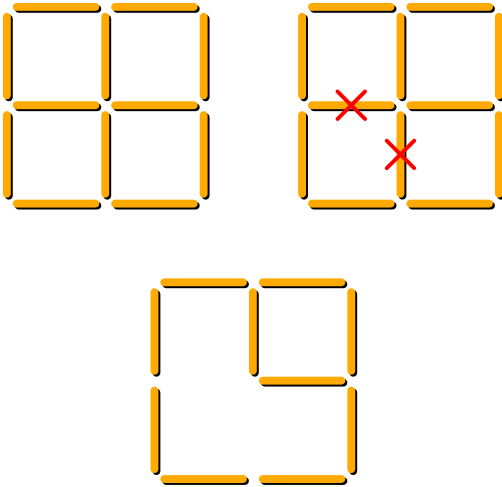

Figure 1. A classic remove-toothpicks puzzle.

Another well-known edit puzzle is Word Morphing, in which the player must transform a starting word into a goal word by repeatedly changing one letter, with the constraint that each intermediate step must itself be a word. For example, the player may be set the challenge of transforming the word **ZOOS** into **CAGE**. One possible solution is:

ZOOS
MOOS
MOO**T**
FOOT
FO**R**T
F**A**RT
CART
CAR**E**
CA**GE**

A word morph is scored by the number of edits used, with a goal of finding a small number of edits. The example used eight moves – but someone with a good vocabulary might succeed with fewer. A teacher might also insist that the intermediate words be polite (disallowing 'FART'), or require that all words come from a class vocabulary list (a severe limitation which would make creating an interesting puzzle more challenging).

In some edit puzzles the goal is to minimise the number of moves, while in others it is to find any successful edit sequence. The toothpick puzzle is an example of the latter. The puzzle statement requires that only two moves be used, so there is only success or failure, not a score.

This article connects the construction and solution of edit puzzles to earlier articles on graph algorithms and their place in puzzle design, presents examples of edit games, and introduces an edit game for elementary math students.

2 The Mathematics of Edit Games

Two things are needed to define a class of edit puzzles: a set of legal configurations and a set of edit operations. Specific constraints on configurations are part of the specification. For example, in the Word Morphing example, only English words are allowed, not arbitrary strings of letters. This

---

[1] http://math.sfsu.edu/cm2/papers/Toothpickgeometry.pdf