



Flowcharts/Pseudocode for SNAP – J. Warfel, D. Wilson

Purpose

Flowcharts and pseudocode are invaluable tools for planning the structure of an algorithm or explaining an algorithm to someone else. They are also very useful to programmers as a first step in coding an application or a method, or in debugging. In this lesson, students use flowcharts or pseudocode to describe three algorithms taken from real life.

Overview

Through flowcharting or pseudocode, students will describe algorithms used in the administration of the Supplemental Nutrition Assistance Program (SNAP, colloquially known as “food stamps”). This is a relevant, real-life application of algorithmic thinking that is surprisingly complex. Students work directly from the information about SNAP available to the general public, not from a textbook-style problem.

Student Outcomes

General AP Computer Science A goals targeted:

Students should be able to develop and select appropriate algorithms and data structures to solve problems. Specifically:

- Students will be able to describe an algorithm through a flowchart/as pseudocode.
- Students will be able to interpret real-world documents mathematically.

Time

The amount of time varies considerably depending on which programming structures the students have been exposed to, whether the instructor limits the set of programming structures they may use, and their experience creating flowcharts or writing pseudocode. There are multiple ways to solve each of the problems; the only way to obtain a reliable estimate is for the instructor to try the problems first, using only the tools students have been exposed to so far.

To explain further: For a student experienced in basic flowcharting, and familiar with conditional statements and arrays or switch/case statements, the first problem could be completed in less than 10 minutes. However, for a student attempting to solve the same problem by using only conditional statements, or by using loop, the problem could take an entire class period.

The third problem is very difficult, with many inputs and subprocedures obtained from the reading; even for an advanced student, this problem alone could require an hour or more.

Level

AP Computer Science



Reach for the Stars is a GK-12 program supported by the National Science Foundation under grant DGE-0948017. However, any opinions, findings, conclusions, and/or recommendations are those of the investigators and do not necessarily reflect the views of the Foundation.

Materials and Tools

[Assignment](#) (either in printed or electronic form)

Internet access *or* Printouts of the reference materials linked in the assignment

Internet access is preferable so that students are able to research unfamiliar terms, but not essential.)

Flowcharting software (such as Visio), if the instructor wants solutions submitted electronically

Preparation

The instructor should choose whether students will be assigned to create flowcharts, write pseudocode, choose between the two options, or be required to complete both. The instructor should also choose the form of submission for solutions.

Prerequisites

This is not a first lesson in flowcharting/pseudocode; it builds on moderate competency in describing logical structures with an interesting, complicated problem.

That said, there are multiple ways to solve each of the problems. This lesson could be used to introduce nested conditional statements, switch/case statements, or loops. Or, if students are already familiar with a variety of logical structures, it could be used to practice logic in general.

The third problem is very complicated and should only be used if students have considerable experience in flowcharting/pseudocode.

Background (directed to students)

In this lesson, you make a flowchart or write pseudocode to describe the algorithms behind a problem from the real world: the application process for SNAP (the Supplemental Nutrition Assistance Program, sometimes called “food stamps”). As you will see, the algorithms behind SNAP are very complicated; applicants must gather a lot of data about their finances and demonstrate their need in several different ways before receiving benefits.

Teaching Notes

See notes regarding a possible preliminary assignment in the Additional Information section.

By design, students are expected to work directly with the source documents describing SNAP. Ideally, the teacher should only have to monitor students while they are working and answer questions about logical structures and the details of flowcharts/pseudocode.

In practice, the source documents use many terms related to household finances that students, as teenagers, are unlikely to be familiar with. Although it is not strictly necessary to understand these terms in order to complete the assignment, some students may become frustrated if they cannot understand them. If internet access is available during the lesson, students can find answers to their questions this way; otherwise, the instructor should be ready to answer questions about the following terms:

For Problem 1: For the purpose of government services (including SNAP), a *household* is a group of people who live in the same dwelling, whether or not they are related. *Monthly gross income* is the total income all members of the household receive before deductions (i.e., before taking out taxes).



For Problem 2: The *monthly net income* is what remains of the monthly gross income after taking out taxes and other admissible deductions. (These deductions are the subject of Problem 3; for Problem 2, students can assume that the monthly net income is given.) The *SNAP benefit* is the amount of money that the household will be given to spend on approved types of food with an EBT card. The SNAP program does not provide households with cash; the benefit can only be used to buy food. Also, not all types of food can be purchased with SNAP – for example, although rules vary by state, SNAP generally cannot be used to buy food in restaurants or “prepared food” in grocery stores.

For Problem 3: *Deductions* are amounts of money that a household is permitted to subtract from their gross income when calculating their net income. Since a household gets more in SNAP benefits if they have a lower net income, they want to have as many deductions as possible. The available deductions are: the *standard deduction* (which every household receives, and which is higher for larger households), the *earned income deduction*, the *medical expense deduction* (which is calculated from a piecewise formula based on the household’s actual medical spending), the *child care and other dependent care deduction*, and the *excess shelter costs deduction* (which only applies to households that spend a lot of money on housing; housing expenses are calculated as the sum of rent, insurance, taxes, and standard utility allowances) **or** the *homeless shelter/utility deduction* (for households that are homeless). (*Standard utility allowances* or *SUAs* are estimates of the utility cost for a household; these are used instead of requiring the applicant to provide utility bills, which can vary considerably from month to month.) Although there are many deductions, each is individually easy to calculate, and is described exactly in the Financial Eligibility document. The difficult aspect of Problem 3 is breaking it down into these small parts.

Some students may be concerned that some of the source information is from Massachusetts and some is from Illinois. Since SNAP is a federal program, benefits and eligibility are determined on a national level, so nearly all of the information is relevant to all states. However, the SUAs used in Problem 3 vary among states. If you prefer that students use the SUA for their state (instead of Massachusetts), please refer to the table at http://www.fns.usda.gov/snap/rules/Memo/SUA_Table.pdf. Some states have a method for choosing which SUAs to apply; for an explanation of the method in Illinois, see <http://www.dhs.state.il.us/page.aspx?item=16170>.

Assessment

The flowcharts/pseudocode should be graded according to the standards set when that content was taught.

Additional Information

Since high school students often have little exposure to the world outside their family and circle of friends, and since SNAP recipients are often portrayed disparagingly in our society, some students may react to the content of this lesson with hostility or derision. If you believe that some students in your class are likely to respond in this way, we recommend that you give the students a preliminary assignment about how people fall into poverty. Some options:

- At playspent.org, there is a game in which you play the role of a parent struggling to survive for a month with \$1000 in savings and a low paying job. Students can be assigned to play this game

and record their reactions to it; or the game can be played as a class; or you can use one of the other lessons we have prepared using playspent.org.

- Individually or as a class, students can watch and write a reaction to *Poor Kids*, a one-hour documentary from Frontline on PBS. The documentary follows several months in the lives of three families struggling with hunger who live in or near the Quad Cities. There is a supplementary video about a child in San Francisco.
<http://www.pbs.org/wgbh/pages/frontline/poor-kids/>
- Have the students read and write a reaction to a summary of *Nickel and Dimed: On (Not) Getting By in America* by Barbara Ehrenreich. From 1998 to 2000, Ehrenreich tried to survive as an unskilled laborer in Florida, Maine, and Minnesota. Her goal was to determine whether it was possible to both live off the money she earned and have enough at the end of the month to pay her next month's rent.
[http://www.wikisummaries.org/Nickel_and_Dimed:_On_\(Not\)_Getting_By_in_America](http://www.wikisummaries.org/Nickel_and_Dimed:_On_(Not)_Getting_By_in_America)

This lesson also provides an opportunity to help students reflect on the misconceptions that they are likely to have about SNAP. The benefits provided by SNAP are much lower than most people realize, and the requirements for receiving them are very stringent.

The funding formula for SNAP is based on a standard of living from many decades ago, in which households were expected to spend approximately 30% of their income on food, 50% on housing, and 20% on everything else. This standard is reflected in the calculations of the SNAP guidelines. (See Problem 2, in which 30% of net monthly income is subtracted from the maximum allotment, and Problem 3, in which excess shelter costs only apply for housing expenses beyond 50% of gross monthly income less all other deductions.) However, on average, Americans currently spend less than 10% of their income on food; so, in order to receive any SNAP benefits, applicants must demonstrate that, relative to their income, they already spend more than three times as much as the average household on food. Furthermore, it is now considered financially unhealthy to spend more than 30% of income on housing.

If students completed Problem 3, they should realize how cumbersome the application process for SNAP can be. Many eligible people do not apply because of the need to gather so much data, and also because completing the process can cause the head of household to miss several days of work. Once a household has SNAP, they must inform the state if anything happens that would change their benefits, such as an increase in income, a change in household size, or a change in deductible expenses. Also, according to a schedule that varies by state, the household must periodically reapply for SNAP in order to continue receiving benefits.

We would like to continue improving this lesson. If you use it, please contact us to tell us about your experience and, if you are willing, modifications that you made to the lesson.

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