FLOWCHARTING

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September 2015
INTRODUCTION

The term “flowchart” is used to describe a special type of illustration depicting the flow of information, control, or responsibility through a series of processes or steps.

By using certain symbols, arranged into columns, connected with arrows and described by labels, a flowchart creator can quickly and easily describe a complex process, allowing a flowchart reader to comprehend relationships between the processes and the movement of data and responsibility between the entities involved in the processing.

The idea of using generic symbols and arrows to illustrate complex modern business processes may have originated with Gilbreth’s scientific study of methods in the 1920’s. Alfred von Neumann’s study of management and control processes in the 1940’s also made use of illustrations and charts utilizing generic symbols, arrows, and labels.

However, modern flowcharting derives its direct parentage from the computer programming field. Pioneered in the 1960’s by large computer organizations like IBM, Control Data, HP, and EDS, and first published as ANSI’s X3.6 standard, flowcharting was the mainstay of procedural computer software design and programming for first, second, and third-generation programming languages.

Accountants and auditors have adapted the programming symbols and techniques, and now use flowcharts to illustrate all kinds of business information flows.

A correctly-drawn flowchart can not only quickly and clearly convey the information’s movement, it can vividly call attention to the loci and nodes of such internal controls as segregation of duties, independent verification, and checks and balances. For this reason, flowcharting is widely accepted as one of the more useful diagnostic tools used during an audit.

For a time in the 1990’s, it appeared that flowcharting might be replaced in this role by more modern techniques such as Data Flow Diagrams (DFD’s) or Semantic Modeling’s Entity-Relationship (E-R) diagramming. Programming moved from procedural language to object-oriented language, which diminished the need for programmers to have the logical flow of information diagrammed so neatly.

Unlike flowcharting, however, these newer (and arguably more elegant) techniques did not enjoy a wide base of business professionals familiar with their symbols, usage, and construction. Nevertheless, the use of traditional flowcharts declined among software developers.

With accountants, however, it was a different story. As accounting began to be computerized, accountants and auditors became familiar with flowcharting symbols and methodology, and adapted flowcharting for use in illustration information flows outside the computer. Information systems professionals and software designers felt that accountants were wasting their time on an obsolete documentation methodology.

But with the arrival of the Sarbanes-Oxley Act in 2002, and its renewed emphasis on internal controls, flowcharting has enjoyed a surprising comeback in popularity among accountants, auditors, and consulting firms. A recent informal survey of audit professionals at the four largest firms and numerous regional firms revealed that creating and reading flowcharts, and diagnosing internal controls from

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flowchart illustrations, will likely remain one of the more essential skills for entry-level accountants and auditors for some time to come.

Unfortunately, the writers of textbooks and the creators of training aids have displayed a disappointing propensity for variety in their materials regarding symbol usage and chart construction. Many are unaware that flowcharting has been uniformly standardized for more than 20 years by the International Standards Organization (ISO 5807 was published in 1985). This standard should be the benchmark for symbol meaning, usage, construction, and good flowchart practice.

This manual has been prepared to introduce the student to the symbols used in flowcharting, and give some simple examples of usage, along with a few simple guidelines for creating flowcharts applicable to accounting, auditing, and internal control.
FLOWCHART SYMBOLS COMMONLY FOUND IN ACCOUNTING AND AUDITING APPLICATIONS

Entity

Terminator

Processing

Manual Operation
Complex Process
Pre-Defined Process

Decision

Computer Operation

Input-Output

Electronic Transmission

Data bases, Data Files, & other Information residing in a computer

Database or Data Files

Paper Documents

Document
Multi-copy Document
Stack of identical Documents
Group of Different Documents

Miscellaneous

Offline Storage, Filing, or TrashBin

Transmittal Tape

Connectors

On-page

Off-page

Information Flow or Responsibility Flow
OBSOLETE SYMBOLS YOU MIGHT ENCOUNTER OCCASIONALLY

- Manual Input (input only)
- Display Screen (output only)
- Database or Data Files
- Tape or Archives
- Event
- Sort
- Extract

NON-STANDARD SYMBOL YOU MIGHT ENCOUNTER OCCASIONALLY

- Tangible Object (inventory, cash/coin, packages, mdse, etc.)
- Stored Data
  
  Archived Data
  
  Archived Reports
  
  etc
Flowcharts use vertical columns, or horizontal lanes, to illustrate the flow of information. A single column (or lane) contains symbols which communicate exactly what a single person (or job title) is doing with the information. The entity or terminator symbol is used to start a flow. In accounting and auditing, it is used to identify a department, an employee position, a job title, or other entity which is doing the work.

The terminator symbol is generally found at the top of each column (or lane) to identify who is doing the activity found in that column or lane. The terminator symbol can sometimes be used to denote a change in department, job title, or entity at the end of a column or lane, where the new entity is at the very end of the flow of interest to the reader. Step through the example below.
The manual operation symbol is used to denote any type of process, operation or work which does not involve a computer or the computer system. Examples would be opening the mail, filling out paper forms, packing merchandise, labeling boxes, counting money, loading trucks, filling orders, and so forth.

A good way to remember the shape of the manual process symbol is to associate it with a work table where manual operations take place..
The Complex Process symbol is used to denote a fairly complex process whose details are not relevant to the purpose of the flowchart. Use this symbol to represent a complicated set of operations when it is not necessary for the reader to know all the details of those operations.

For example, a scheduling manager uses a very complex process to determine the manufacturing schedule and create the job sheets. If the reader does not need to know the details of that process, but rather only needs to know that it the scheduling manager determines and creates the production schedule and creates the job sheets, you can let the process symbol represent that operation.

Important: Do not use the process symbol if one some other flowchart symbol will accurately portray the activity. For example, do not use the process symbol for computer input/output, or simple manual operations such as filling out a document or packing merchandise.
The Pre-Defined Process is used for a complex process which is defined, described, or even drawn at some other place within the flowchart or its accompanying documentation. The symbol text should give the name of the process and clearly state where the details can be found.

The symbol can sometimes be used to describe a process whose description is the subject of a stand-alone manual or other specific documentation. But this symbol should not be used unless the process is fully described somewhere else in writing.
DECISION OR COMPARISON SYMBOL

The decision symbol is used for branching. Decisions are always binary, phrased as simple "Yes" or "No" questions. The question must appear in the symbol. If the question is too long to appear in the symbol, the name of the decision should appear in the symbol, and the question should be listed somewhere on the page in a text or comment box.

Remember, all decisions on flowcharts must be binary. Only yes-no (or true-false) answers are acceptable. A non-yes-or-no question must be illustrated as a series of binary decisions.

Credit Manager

Order

Is order more than $100

No

To p.115

Yes

Is order more than $1000

No

To p.117

Yes

Is order more than $10,000

No

To p.119

Yes

To p.131
The data input/output symbol denotes any type of input to a computer and/or output from a computer. It generally denotes interactive input, but it can be used for ANY input process. Examples of data input include swiping a magnetic card, scanning with a laser wand, using a touch-tone telephone keypad, or any other type of computer input. You can consider it a catch-all symbol for data capture.

Today, the symbol is used for input alone and also is used to denote an interactive input function, e.g., an input operation accompanied by simultaneous feedback (output), such as entry at a computer terminal where the operator keys in data and immediately sees it on the screen with validation error messages, confirmation messages, etc. This symbol is not typically used for output alone.

A single input/output symbol can indicate the printing of report as well as data entry and display as long as the report is printed as part of, or at the end of, a sequence of input processes.
This “lightning-bolt” arrow is used to denote electronic data transmission moving on a public infrastructure. It can be used for telephone calls, but today is mainly used for data transmission, usually over the internet, dial-up, leased lines, or other WAN architecture. This symbol is often used for email, and computer-to-computer communication between systems or companies. It is sometimes used to denote interactive activity taking place over the internet, such as downloads, e-commerce, etc.

This symbol is not used for LAN transmissions; a simple straight arrow is typically used to show data moving on a LAN.

Some organizations have erroneously used this arrow to denote any type of movement to data to a remote site. For example, a few organizations have used this symbol to denote the use of U.S. Postal mailings, or FedEx courier transportation. This usage is not standard and should be discouraged outside those particular organizations.
The data symbol is used to denote an electronic data file or database stored on a local computer. Generally, it is used for on-line storage which can be accessed by the computer without intervention by a human. Intervention by a human (such as loading a CD into a drive, etc.) would preclude the use of this symbol, unless the intervention were also used (via the manual process symbol).

The symbol is used for both batch files and on-line update files. The name of the file or database should be displayed in the symbol. If the file is a batch file, the word "Batch" should be used as part of the file name.

The symbol can have arrows leading into and out of it to denote reads from the file and writes to the file. If a process is merely adding records, an arrow should go into the file. If a process is merely reading from the file, the arrow should come out of the file. If the process is reading and writing to the file, a single line with heads on each end can denote the read/write combination.

Since it is assumed that files and databases reside on the computer, a file can appear without having to be explicitly created on the flowchart. It is assumed that some other computer process created the file. Likewise, a file can does not have to go somewhere – it is assumed the file will reside on the computer unless some other process erases it, clears it, or archives it.
This symbol is being used by more and more organizations instead of the previous data symbol to represent data files and databases.

The original symbol (previous page) originated when data was stored on a magnetic drum mechanism. Today, most data is stored on a disk. Hence, this symbol more closely resembles the cylindrical nature of a modern data disk than the previous symbol.

While both symbols are commonly found in flowcharts today, it is important for you to ascertain which symbol is used by your organization, and use only the symbol adopted by your company or firm.
The document symbol is used to represent almost any kind of paper containing information, including order forms, reports, purchase orders, invoices, checks, work orders, receipts, etc. The only kinds of paper not represented by the document symbol are currency, and transmittal tapes (adding machine tapes created to total a batch of transactions).

Documents must originate somewhere, and their origination point must be illustrated or specified as part of the flowchart. Also, documents must ultimately go somewhere, even if in the trash bin, and their final destination must also be specified somewhere within the flowchart.

A document which enters a process (manual, complex, or predefined) must also emerge from that process. It is also mandatory to repeat the document symbol after every branch in the flow so the reader can tell where the document is at all times on the chart. Document symbols must also be repeated any time you change pages or entities.

Duplicate copies of a document are designated by multiple document symbols stacked on each other, with close spacing between the symbols.

A stack of identical documents (e.g., a stack of orders, or a stack of invoices) is generally denoted by one single document symbol. An exception is sometimes made where the stack is accumulated over a lengthy time period, such as an hour or more, or half a day or more. If the stack of identical documents is gathered over a time period, it is then acceptable to show it as stacked symbols to more clearly indicate that it is an accumulation. The stack must be closely spaced.

Different documents all following the same path in the flow are designated by overlapping document symbols, with more space between the symbols than found with multiple-copy documents. For example, a customer order with its accompanying bill of lading, packing slip, and loading authorization might be denoted by a stack of spaced-out document symbols.
EXAMPLES OF PROPER USE OF THE DOCUMENT SYMBOL

Clerk
Creates Work Order in Triplicate
Work Order (3 copies)

Supervisor
Initials Work Order (all 3 copies)
Work Order (copy 3)

Scheduler
Assigns Work Order to Maintenance Team
Work Order (copies 1 & 2)

Team Leader
Work Order Copy 1
Work Order Copy 2
Active WO File
Lead Foreman

Tickler File

Work Order (copies 1 & 2)
EXAMPLES OF PROPER USE OF THE DOCUMENT SYMBOL

Sales Dept
Takes Phone Order, Creates Sales Order Form
Sales Order Form

Credit Dept
Obtains Dun & Bradstreet Credit Rating
Sales Order Form
D&B Rating Report

Credit Manager
Credit Approved?

Sales Order Form
D&B Rating Report
Factory

Sales Order Form
D&B Rating Report
Sales Service
EXAMPLES OF INCORRECT USE OF DOCUMENT SYMBOL

A document cannot simply appear out of thin air. It must either come from another entity (such as a customer, sales rep, etc.) or must be created by a process.

The Sales Order document went into the "Enters Data to Sales Screen" process, but never emerged. The flowchart must show what happened to the document. If it went into a file cabinet, then show the document going into a file. If it was discarded (unlikely), then show it going into "File 13".

The Daily Sale Summary report must be generated by a process. Reports don't just appear instantaneously from computer files. If the sales summary report is printed by the Sales Department as the last step in the process of "Enter Data to Sales Screen", then the report should be shown coming out of the "Enter Data" manual process symbol rather than the computer file. If printing the report is an entirely different process, there should be an additional process symbol for "Print Daily Sales Summary Report".
**OFF-LINE STORAGE SYMBOL**

This symbol originally stood for electronic data files which were not accessible by the computer without human intervention, such as disk files where the disk was dismounted (removed) from the computer. It was sometimes called the “merge” symbol, because the chart was often illustrating the “addition” or “merging” of current data into the already-stored offline data file. It is still sometimes used by a few software designers for electronic storage of archive files, such as on a CD, DVD, or other archive medium.

However, in most auditing and accounting flowcharts, the symbol is widely used to denote a non-electronic file, such as a filing cabinet, a binder, a file folder, or some other physical storage location. It is often used to denote pending files, tickler files, and other holding areas. The name “merge” is not used by modern accountants, although technically, the operation being illustrated is the “merging” of the document into the storage location.

Another use for the symbol is to denote "File 13", the trash can, denoting the discarding or destruction of a document.
The transmittal tape represents a thin paper tape generated by a printing calculator, adding machine, cash register, or other mechanical device. A transmittal tape is generally used to verify, substantiate, or support a total of some kind. It is essentially a list of the items with their total. Thus, the transmittal tape generally accompanies a set of documents, or comes from a process totaling or analyzing documents.

For example, the daily collection of checks received from customer will be totaled by a clerk on a printing calculator. The stack of checks will be sent, together with the tape listing, to a second clerk, who will key the amounts into a computer. The computer will add the amounts keyed, and the total from the computer will be compared to the total on the transmittal tape. This will make sure that (a) the clerk originally added the checks correctly, and (b) the entry clerk entered the correct amounts into the computer. If the totals do not match, one of the clerks apparently made a keying error and an investigation should be conducted.
ON-PAGE CONNECTOR

The On-Page connector is used to avoid convoluted lines on a page. Traditionally, on-page connectors use single letters of the alphabet, starting over with "A" on each page. These connectors must be used in pairs. The flow enters one connector with a letter, and exits another connector with the same letter.
The Off-Page Connector is used to show a flow moving from one page to another. When the flow leaves a page, the symbol must show the page number where the flow is continued. If the target page contains more than one off-page connector (coming onto the target page), then the connector on the source page must also contain a letter showing which connector on the target page continues the flow.

On the target page, the off-page connector must contain the word "From", and the source page number. If more than one off-page connector originates from the same source page directing to the same target page, letters must be used as described above.

It is good practice to always repeat any document symbols immediately before the origin off-page connector, and immediately after the target off-page connector. Additionally, you must clearly indicate the entity doing the processing on the target page, even if this means repeating the entity symbol.
Generally, the overall flow should move down and to the right on the page. Arrows should generally travel vertically or horizontally only. Diagonal arrows can look sloppy unless their angles are carefully matched.

Occasionally part of a flow will move left or up. In cases where the flow moves up, good practice is to orient the arrow so that the arrowhead is always pointing down or sideways.

**Correct**

Clerk

Creates Requisition

Purchase Requisition

**Acceptable**

Creates Requisition

Purchase Requisition

**Incorrect**

Creates Requisition

Purchase Requisition

Supervisor
This symbol is generally obsolete, but you may occasionally find it on older flowcharts. It has generally been replaced with the input/output symbol.

The manual input symbol was used to denote keyboard entry by a human operator into a computer, usually without feedback or instant validation or verification. Examples would be batch entry of data via computer terminal, touch-tone keypad entry, swiping of a magnetic card, or reading of a bar-code. Because this symbol denotes input with little or no feedback to the operator, it has fallen into disuse, since today most input of this nature is accompanied by immediate validation and verification to the operator of proper or improper input.

Unlike the more versatile input/output symbol, the manual input symbol can not be used to denote the printing of a batch report or summary report, nor can it be used to denote edit checks and data validation; it denotes pure input only.
The display symbol is also generally obsolete, but still found on legacy flowcharts. It is used primarily by information systems designers to denote data displayed on a screen rather than printed on a printer. It is rarely used in accounting and auditing. However, you may encounter it on some technical flowcharts. Usually it will denote an inquiry rather than update operation.
This symbol derives its origin from the old drum storage of computers in the 1960’s. Today, however, it is generally obsolete, and has been replaced with one of the two more common database or data file symbols described earlier. However, you may still encounter it on legacy flowcharts.

Originally, these three symbols had their own individual and separate meaning. The left symbol referred to data which was in main drum storage in the computer’s processor (drum storage was used in the 1960’s but has since been replaced by what we today call “RAM” memory). Hence the left symbol is rarely if ever used on modern flowcharts.

The middle symbol is a simplified rendering of the left symbol, but has evolved to mean any on-line data immediately accessible and available for processing. Since most modern databases and data files are on-line and immediately accessible, this symbol is generally used to denote modern databases and computer files.

The right symbol originally referred to magnetic disk platters which typically could be removed and taken off-line, but easily restored to on-line status.

While the center symbol is still probably the preferred symbol for databases and data files, the symbol on the right is sometimes used for this purpose, under the reasoning that most of today’s on-line data storage is stored on hard disks.

Although some purists discourage the use of the right symbol (since most of today’s hard disks cannot easily be removed from the computer system), whether to use the center or right symbol is generally up to organizational preference. The middle symbol is by far the most popular.
This symbol, which looks like a tape reel, is generally obsolete today. Originally, it was used to denote an electronic data file which cannot be accessed randomly, but must be read through sequentially to find a particular record. Historically, these type of files were stored on magnetic tape. However, in these days of cheap direct-access media such as terabyte hard drives, thumb drives, and SD cards, sequential access storage has become quite rare.

You still need to recognize the symbol since it frequently is found on legacy system flowcharts, especially in conjunction with tape backups and tape archives.
EVENT SYMBOL (OBSOLETE)

This symbol is also generally obsolete, but can occasionally be found depicting an event which triggers processing or action. In modern flowcharts, it is more common to simply describe the event with a comment or annotation.

This symbol is sometimes used (erroneously) as a process symbol, since the rounded corners are more pleasing to the eye than the sharp corners of the process rectangle, and can be more easily differentiated from arrows on a cluttered page full of symbols.

SORT SYMBOL (OBSOLETE)

This symbol originated as a programming symbol representing a sort operation. While it is not used for this purpose in accounting and auditing, its availability on drawing palettes has led some organizations to use it for special purposes. The use of this or any symbol in a non-standard way is strongly discouraged.

EXTRACT SYMBOL (OBSOLETE)

This symbol originated as a programming symbol representing an extraction operation, such as selecting certain records from a file. While it is not used for this purpose in accounting and auditing, its availability on drawing palettes has led some organizations to use it for special purposes. The use of this or any symbol in a non-standard way is strongly discouraged.
The square with inside lines originally represented “internal” computer storage in the programming field, but was quickly replaced by other data representation symbols. Hence, it is the most commonly “re-used” or “mis-used” symbol on the flowcharting palette. Today, this symbol is applied in a non-standard way more than any other. It is widely used as a multi-purpose symbol, and represents different things in different organizations and applications.

Because of the symbol’s similarity to a box, many organizations use this symbol to denote something physical, such as merchandise, inventory, packages, pallets, or other physical goods. It is often used to denote cash and coin, such as that found in a bank bag. It is sometimes used to represent archival storage, archived reports, or other rarely-accessed off-line data storage. The exact nature and identity of the item represented by the symbol might be obvious from context, but it is good practice to identify the symbol’s meaning on the flowchart if it can be done with one or two words.

Again, the use of any symbol in a non-standard way is strongly discouraged. However, the use of this symbol to represent tangible articles is so widespread as to border on becoming acceptable usage.
NOTES AND REMINDERS

Flowcharts should be clean and neat. If your flowchart is too complicated, break it into two or more pages.

Flowcharts should be simple to follow.

Flowcharts should be drawn with the intended audience in mind. Do not include unnecessary details, but be sure to include sufficient details for the intended audience to achieve the objective.

Don't clutter up the chart repeating symbols unnecessarily, but be sure to repeat symbols wherever necessary for clarity. In general, repeat all document symbols anytime the document changes hands.

The flow should always move chronologically, down the page and to the right. Use "columns" or lanes to denote different job functions or different departments. Be sure it is always completely clear exactly who is doing the process. Avoid using a single column or lane for more than one entity’s work; if lanes must overlap due to space considerations, be sure they are noticeably offset from each other.

The flow is assumed to move down. You must use arrowheads on any connecting line which moves any direction but straight down. But it is a good habit to always use arrowheads, even when the flow of connecting lines does go straight down.

Don't make your reader have to flip back and forth between pages to follow a simple flow. Put sufficient symbols on each page so that each page is a relatively stand-alone depiction.

Always start with a terminator showing who or what is doing the activity. Repeat the terminator anytime it is unclear who is performing the process, or anytime an entity picks up the flow again.

Be sure your decisions are binary, and have one flow going into the diamond, and two flows (one "yes" and one "no") coming out.

Be sure it is clear where every document is located at every point in the process. If there is some ambiguity, repeat the document symbol to show exactly where a document is located in the flow.

Be sure all documents end up somewhere and don't just disappear.

Check your flowchart for consistency in naming. If you call a document a "Sales Order" in one place, be sure to call the document "Sales Order" on all other places. Don't call it "Sales Order" on one page, and "Order Form" on another page. Always use the formal name for the document (the one printed at the top of the actual form or report).

The same with file names: If you call the electronic file "Sales Batch" one place, be sure you call it "Sales Batch" in all other places.

The same with off-line storage symbols. A file should not be called "Order File" on a page if you have referred to it as "Sales File" on another page.
If necessary for clarity, don't hesitate to add explanatory text to your flowchart. Many professional flowcharts have a text narrative beside the flowchart giving details of what is going on in the processes being illustrated.

If the reader will need extensive text and explanation, it is becoming acceptable to write the narrative text in a document, and use the flowchart as an illustration. In these cases, labels and tags may appear in the flowchart to serve as reference points from the narrative.

Every page should be labeled with a short description of the activity being portrayed on that page, as well as page number if the flowchart consists of more than a single page.

Don't ever create a flowchart without making sure it has the author's name, date of creation, company name and title of the process being illustrated.
SAMPLE FLOWCHART

On the following page is an example of a fairly well-drawn flowchart. Notice the “loops” or circles formed by the flows. Each loop or circle indicates a segregation of duties, an independent verification, or a checks & balances combination.

This chart has one non-standard feature: the dotted lines connecting the database symbols. The dotted lines make it clear that the computer files are part of the internal control loop.

You can find a couple of technical drawing flaws on this chart. One is the “up-pointing” arrowheads in the upper left corner. What are the others?