Designing Accurate Data Entry Procedures

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Systems Analysis and Design, 7e

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Learning Objectives

- Understand the uses of effective coding to support users in accomplishing their tasks
- Design effective and efficient data capture approaches for people and systems
- Recognize how to ensure data quality through validation
- Articulate accuracy advantages of user input on ecommerce Web sites

Accurate Data-Entry Objectives

- Effective coding
- Efficient data capture
- Effective data capture
- Assuring data quality through validation

Major Topics

- Effective coding
- Types of codes
- Guidelines for coding
- Validation methods
- Check digits
- Ecommerce accuracy

Effective Coding

- Data that are coded require less time to enter
- Coding helps to reduce the number of items entered
- Coding can help in sorting of data during the data transformation process
- Coded data can save valuable memory and storage space

Human Purposes for Coding

- Keeps track of something
- Classifies information
- Conceals information
- Reveals information
- Requests appropriate action

Keeping Track of Something

- Simple sequence code
- Alphabetic derivation codes

Simple Sequence Codes

- A number that is assigned to something if it needs to be numbered
- No relation to the data itself

Figure 15.1 Using a simple sequence code to indicate the sequence in which orders enter a custom furniture shop

Order #	Product	Customer
5676	Rocking Chair/with Leather	Arthur Hook, Jr.
5677	Dining Room Chair/Upholstered	Millie Monice
5678	Love Seat/Upholstered	J. & D. Pare
5679	Child's Rocking Chair/Decals	Lucinda Morely

Simple Sequence Codes (Advantages)

- Eliminates the possibility of assigning the same number
- It gives users an approximation of when the order was received

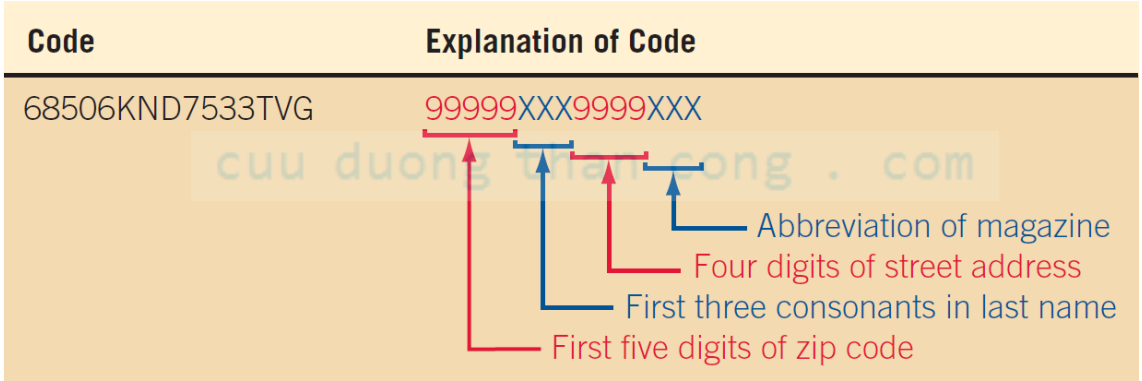
Simple Sequence Codes (Disadvantages)

- When you do not wish to have someone read the code to figure out how many numbers have been assigned
- When a more complex code is desirable to avoid a costly mistake

Alphabetic Derivation Codes

- A commonly used approach in identifying an account number

Figure 15.2 Identifying the account of a magazine subscriber with an alphabetic derivation code



Alphabetic Derivation Codes (Disadvantages)

- When the alphabetic portion is small or when the name contains fewer consonants than the code requires
  - Names like ROE - become RXX
- Some of the data may change

Classification Information

- Affords the ability to distinguish between classes of items
- Must be mutually exclusive
- Classification codes
- Block sequence codes

Classification Codes

- Used to distinguish one group of data with special characteristics from another
- Can consist of either a single letter or a number
- A shorthand way of describing a person, place, thing, or event
- Listed in manuals or posted so that users can locate them easily

Classification Codes

- Use a single letter for a code

Figure 15.3 Grouping tax-deductible items through the use of a one-letter classification code

Code	Tax-Deductible Item
I	Interest Payments
M	Medical Payments
T	Taxes
C	Contributions
D	Dues
S	Supplies

Block Sequence Codes

- An extension of the sequence code
- Data are grouped according to common characteristics
- Simplicity of assigning the next available number (within the block) to the next item needing identification

Figure 15.5 Using a block sequence code to group similar software packages

Code	Name of Software Package	Type
100	Netscape	Browser
101	Internet Explorer	
102	Lynx	
.	.	
.	.	
.	.	
200	Access	Database
201	Paradox	
202	Oracle	
.	.	
.	.	
.	.	
300	Microsoft Word	Word Processing
301	WordPerfect	
.	.	
.	.	
.	.	
400	Astound	Presentation
401	Micrografx Designer	
402	PowerPoint	

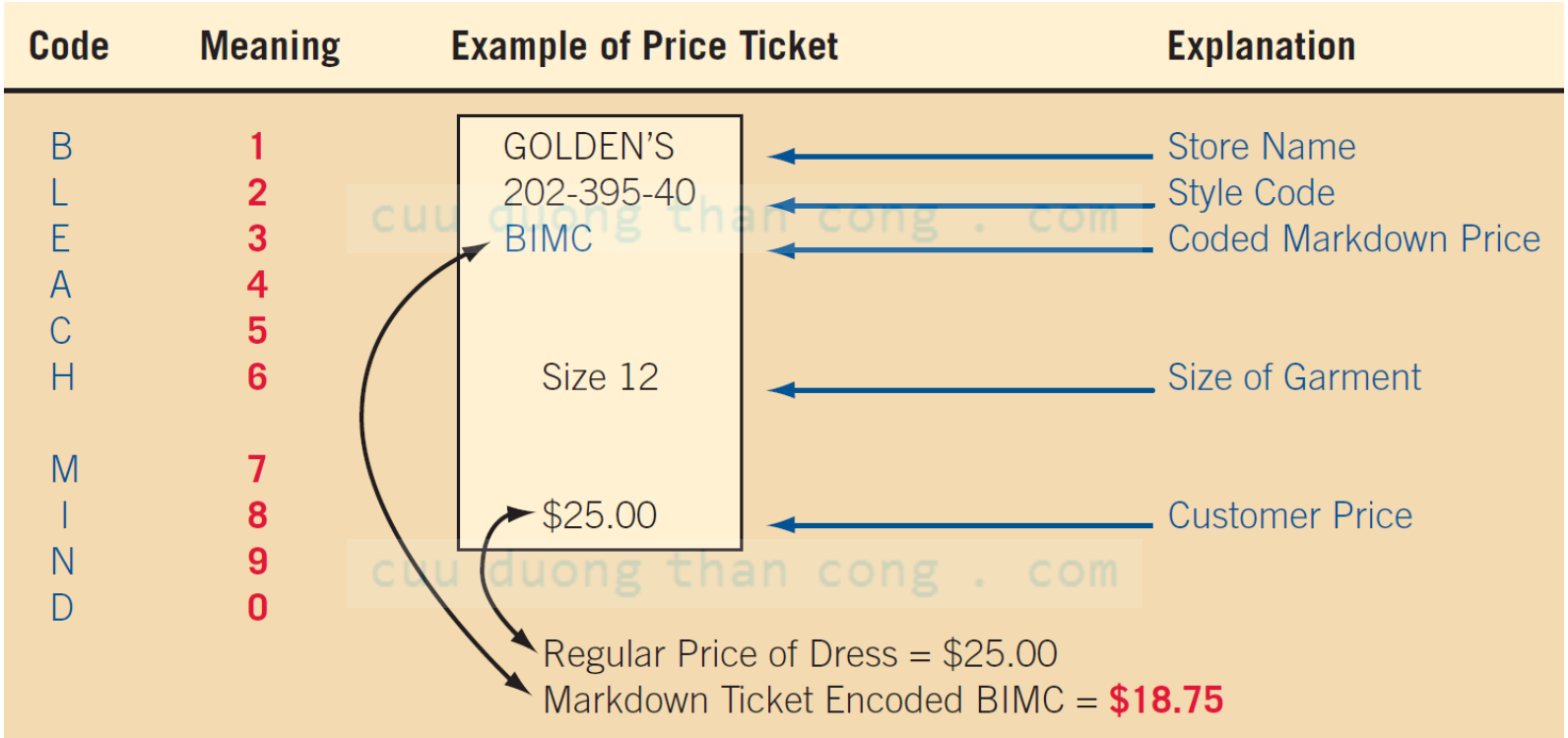
Concealing Information

- Codes may be used to conceal or disguise information
- Cipher Codes

Cipher Codes

- The direct substitution of one letter for another, one number for another, or one letter for a number

Figure 15.6 Encoding markdown prices with a cipher code is a way of concealing price information from customers



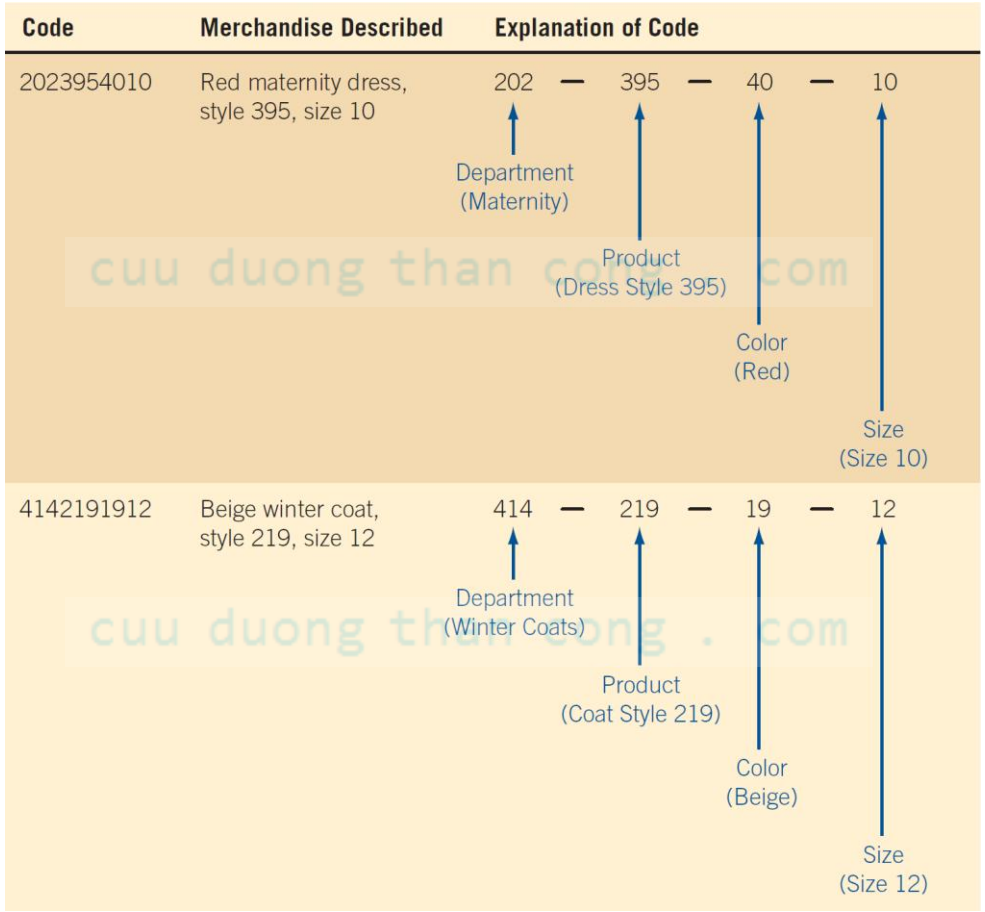
Revealing Information

- Sometimes it is desirable to reveal information to specific users through a code
- Makes the data entry more meaningful for humans
- Significant-Digit subset codes
- Mnemonic codes
- Unicode

Significant-Digit Subset Codes

- Used to help describe a product by virtue of its membership in many subgroups
- Possible to locate items that belong to a certain group or class
- Inquiries may be performed on a portion of the code
- Useful for a marketing product

Figure 15.7 Using a significant-digit subset code helps employees locate items belonging to a particular department



Mnemonic Codes

- A mnemonic (pronounced nî-môn'-ïk) is a human memory aid
- Any code that helps the data-entry person remember how to enter the data or the user remember how to use the information is a mnemonic
- Using a combination of letters and symbols affords a clear way to code a product so that the code is easily seen and understood

Figure 15.8 Mnemonic codes function as memory aids by using a meaningful combination of letters and numbers

Code	City Hospitals
BGH	**B**uffalo **G**eneral **H**ospital
ROS	**Ros**well Park Memorial Institute
KEN	**Ken**more Mercy
DEA	**Dea**coness Hospital
SIS	**Sis**ters of Charity
STF	**S**aint **F**rancis Hospital
STJ	**S**aint **J**oseph's Hospital
OLV	**O**ur **L**ady of **V**ictory Hospital

Unicode

- Includes all standard language symbols
- Has room for 65,535 characters
- The full set of Unicode characters are grouped by language and may be found at www.unicode.org

Requesting Appropriate Action

- Instruct either the computer or the decision maker about what action to take
- Function codes

Function Codes

- Short numeric or alphanumeric codes used to spell out precisely what activities are to be accomplished

Figure 15.9 Function codes compactly capture functions that the computer must perform

Code	Function
1	Delivered
2	Sold
3	Spoiled
4	Lost or Stolen
5	Returned
6	Transferred Out
7	Transferred In
8	Journal Entry (Add)
9	Journal Entry (Subtract)

General Guidelines for Coding

- Be concise
- Keep the codes stable
- Ensure that codes are unique
- Allow codes to be sortable
- Avoid confusing codes
- Keep the codes uniform
- Allow for modification of codes
- Make codes meaningful

Be Concise

- Overly long codes mean more keystrokes and consequently more errors
- Long codes also mean that storing the information in a database will require more memory
- Short codes are easier for people to remember and easier to enter
- If codes must be long, they should be broken up into subcodes

Keep the Codes Stable

- Stability means that the identification code for a customer should not change each time new data are received
- Don’t change the codes in a mnemonic system

Ensure That Codes Are Unique

- For codes to work, they must be unique
- Do not assign the same code number or name to the same items

Allow Codes to Be Sortable

- Make sure that users can do what you intend to do with the codes you create
- Numerical codes are much easier to sort than alphanumeric data

Avoid Confusing Codes

- Avoid using coding characters that look or sound alike

Figure 15.12 Combining look-alike characters in codes can result in errors

Code Format for Canadian Postal Code X9X 9X9			
Handwritten Code	**Actual Code**	**City, Province**	**Problem**
L8S 4M4	L8S 4M4	Hamilton, Ontario	S looks like a 5
T3A ZE5	T3A 2E5	Calgary, Alberta	2 looks like a Z 5 looks like an S
L0S 1J0	L0S 1J0	Niagara-on-the-Lake, Ontario	Zero and Oh look alike S looks like a 5 1 looks like an l

Keep the Codes Uniform

- Need to follow readily perceived forms
- Keep codes uniform among as well as within programs

Allow for Modification of Codes

- The system will evolve over time
- The coding system should be able to encompass change

Make Codes Meaningful

- Effective codes contain information
- Should make sense to people using them
- Easier to understand, work with, and recall

Using Codes

- Validation programs
- Report and inquiry programs
- GUI programs

Effective and Efficient Data Capture

- Deciding what to capture
- Letting the computer do the rest
- Avoiding bottlenecks and extra steps
- Starting with a good form
- Choosing a data-entry method

Deciding What to Capture

- Data that change or vary with every transaction
- Data that concisely differentiate the particular item being processed from all other items

Letting the Computer Do the Rest

- Recording the time of the transaction
- Calculating new values from input
- Storing and retrieving data on demand

Avoiding Bottlenecks and Extra Steps

- Data are poured rapidly into the wide mouth of the system only to be slowed in its "neck" because of an artificially created instance of insufficient processing for the volume or detail of the data being entered
- The fewer steps involved in inputting data, the fewer chances there are for the introduction of errors

Starting with a Good Form

- With effective forms, it is not necessary to reenter information that the computer has already stored, or data such as time or date of entry that the computer can determine automatically

Choosing a Data-Entry Method

- Keyboards
- Optical character recognition
- Magnetic ink character recognition
- Mark-sense forms
- Bar codes
- RFID

Keyboards

- Special function keys to open programs
- Keys used to scroll and explore the Web
- Keys that can be programmed with macros to reduce the number of keystrokes required
- Ergonomic keyboards and infrared or Bluetooth-enabled keyboards

Optical Character Recognition

- Increased speed
- Eliminates many of the time-consuming and error-fraught steps of other input devices
- Decentralizes responsibility for quality data directly to the unit that is generating it
- The transformation of faxes into documents that can be edited

Magnetic Ink Character Recognition

- A reliable and high-speed method that is not susceptible to accepting stray marks
- If it is required on all withdrawal checks, it serves as a security measure against bad checks
- Data entry personnel can see the numbers making up the code if it is necessary to verify it

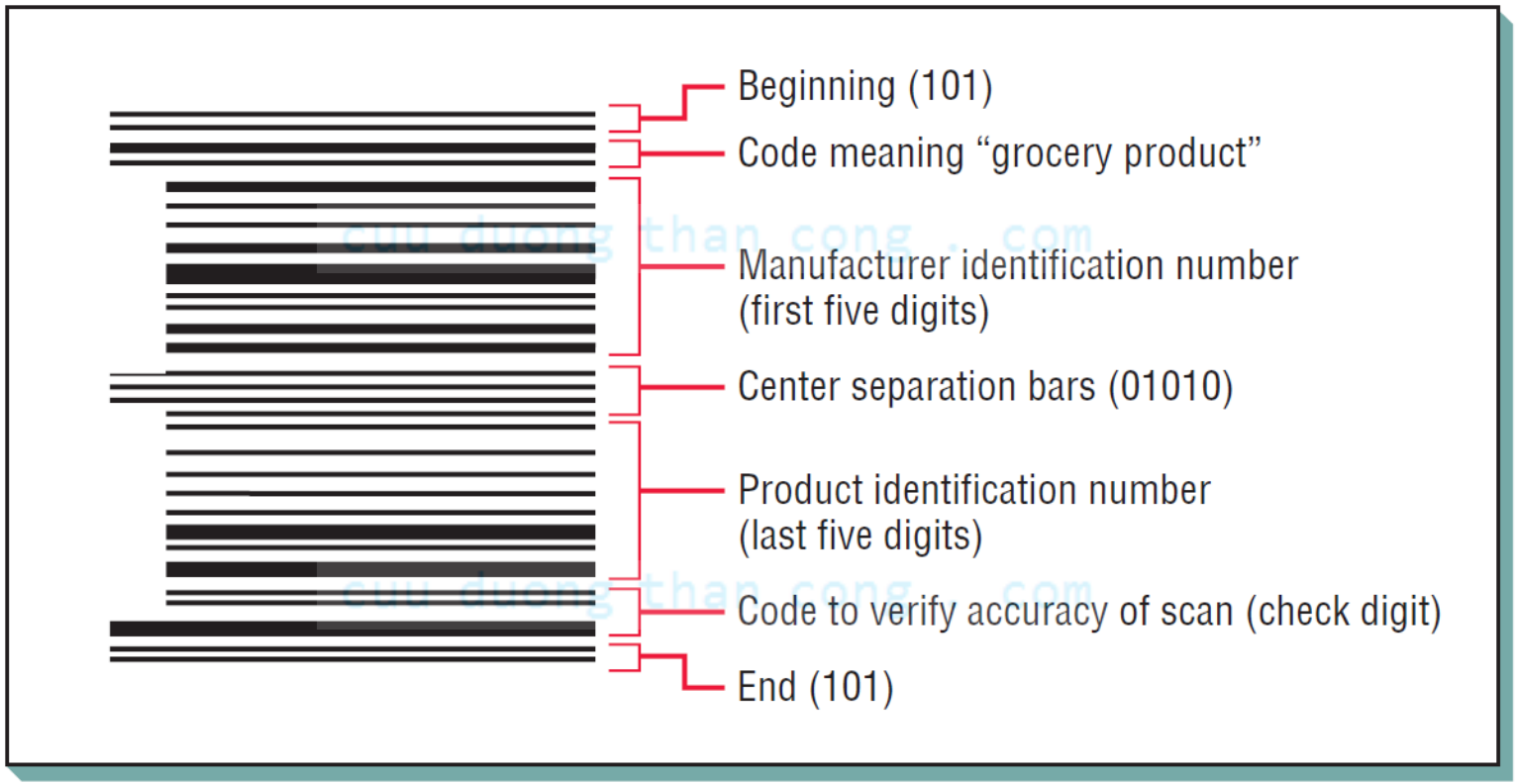
Mark-Sense Forms

- Little training of entry personnel is necessary
- A high volume of forms can be processed quickly
- Stray marks on form can be entered as incorrect data
- Choices are limited to the answers provided
- Difficulty in capturing alphanumeric data
- Easy to get confused and put a mark in an incorrect position

Bar Codes

- Affords a high degree of accuracy for data entry
- Saves labor costs
- Allows the automatic capturing of data
- Tracking of credit card purchases

Figure 15.17 Bar coding, as shown on this label for grocery product, affords highly accurate data entry. Used with the permission of the Uniform Code Council, Dayton, Ohio



RFID

- Allows the automatic collection of data using RFID tags that contain a chip and an antenna
- Passive RFID tags
- Active RFID tags
- Privacy is a concern

Ensuring Data Quality through Input Validation

- The critical importance of catching errors during input, prior to processing and storage cannot be overemphasized
- Potential problems
  - Validating input transactions
  - Validating input data

Figure 15.18 Validating input is important to ensure that most potential problems with data are eliminated early

This Type of Validation	Can Prevent These Problems
Validating Input Transactions	Submitting the wrong data Data submitted by an unauthorized person Asking the system to perform an unacceptable function
Validating Input Data	Missing data Incorrect field length Data have unacceptable composition Data are out of range Data are invalid Data do not match with stored data

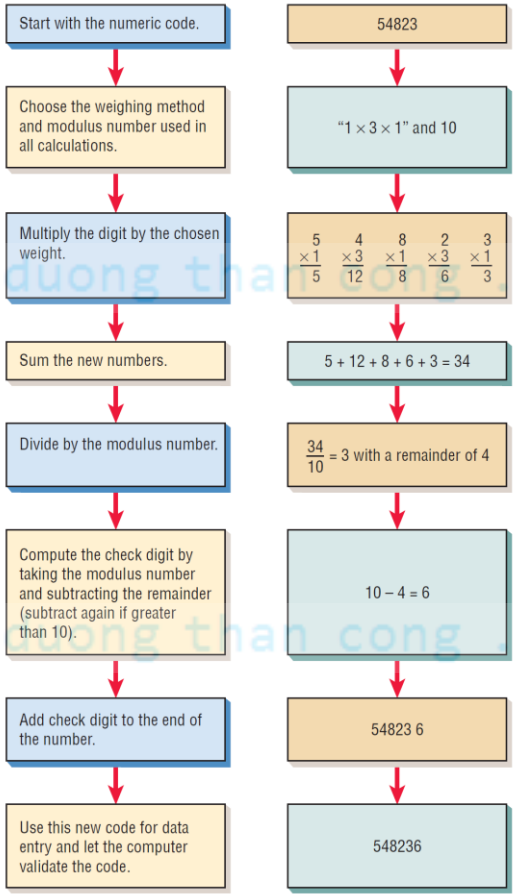
Validating Input Transactions

- Submitting the wrong data
- Submitting of data by an unauthorized person
- Asking the system to perform an unacceptable function

Validating Input Data

- Test for missing data
- Test for correct field length
- Test for class or composition
- Test for range or reasonableness
- Test for invalid values
- Cross-reference checks
- Test for comparison with stored data
- Setting up self-validating codes (check digit)

Figure 15.19 Steps in converting a five-digit number to a six-digit number containing a check digit



The Process of Validation

- Check first for missing data
- Check the syntax
- Check the semantics
- GUI screens can help to reduce the number of human input errors when they incorporate radio buttons, check boxes and drop-down lists

The Process of Validation (Continued)

- Regular expressions
- Validating XML documents
  - DTD
  - Schema

Figure 15.22 These characters are used in regular expression (pattern) validation

Character Code	Meaning Used in Regular Expression Validation
\d	Any digit 0–9
\D	Any nondigit character
\w	Any letter, number, or underscore
\W	Any character other than a letter, number, or underscore
.	Matches any character
[characters]	Matches the characters in the brackets
[char-char]	Matches the range of characters
[a–z][A–Z][0–9]	Will accept any letter or digit
[^characters]	Match anything other than the characters
[^char-char]	Match anything outside the range of characters
[^a–z]	Will accept anything except lowercase letters
{n}	Match exactly n occurrences of the preceding character
{n,}	Match at least n occurrences of the character
\s	Any white space formatting character (tab, new line, return, etc.)
\S	Any non-white space character

Accuracy Advantages in Ecommerce Environments

- Customers generally key or enter data themselves
- Data entered by customers are stored for later use
- Data entered at the point of sale are reused throughout the entire order fulfillment process
- Information is used as feedback to customers

Summary

- Quality of data
  - Effective coding
  - Effective and efficient data capture
  - Validation of data

Summary (Continued)

- Coding
  - Sequence codes
  - Alphabetic derivation codes
  - Classification codes
  - Block sequence codes
  - Cipher codes
  - Significant-digit subset codes
  - Mnemonic codes
  - Uniform character set
  - Function codes

Summary (Continued)

- Input devices
  - Keyboards
  - OCR
  - MICR
  - Mark-sense forms
  - Bar codes
- Input validation
  - Input transaction
  - Input data
- Ecommerce