# MIS 5206
# Protecting Information Assets

- Unit#3 -

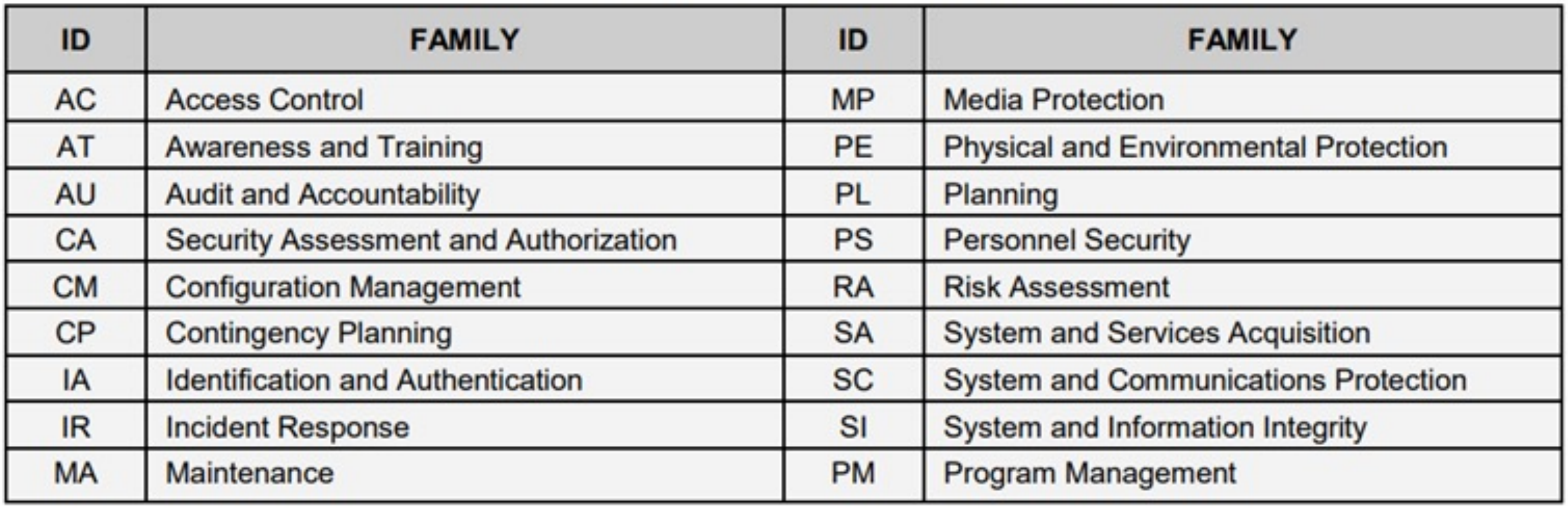
# Data Classification Processes and Models

# Agenda

- Vocabulary
- Data Classification Process and Models
- Test taking tip
- Quiz

# Information Systems Security Controls

**TABLE 1: SECURITY CONTROL IDENTIFIERS AND FAMILY NAMES**



| ID | FAMILY | ID | FAMILY |
|---|---|---|---|
| AC | Access Control | MP | Media Protection |
| AT | Awareness and Training | PE | Physical and Environmental Protection |
| AU | Audit and Accountability | PL | Planning |
| CA | Security Assessment and Authorization | PS | Personnel Security |
| CM | Configuration Management | RA | Risk Assessment |
| CP | Contingency Planning | SA | System and Services Acquisition |
| IA | Identification and Authentication | SC | System and Communications Protection |
| IR | Incident Response | SI | System and Information Integrity |
| MA | Maintenance | PM | Program Management |

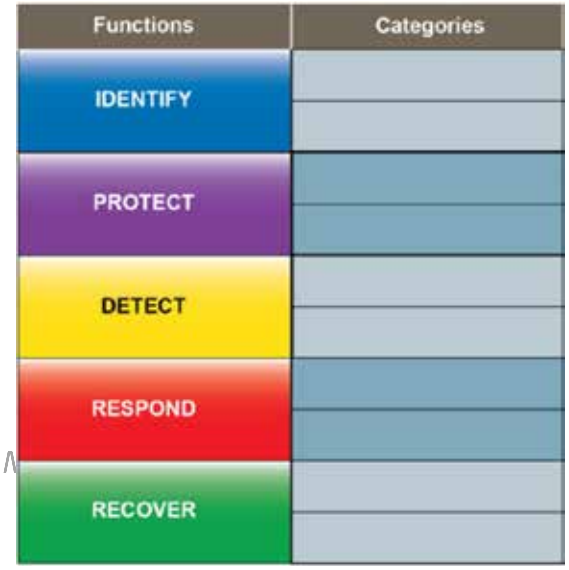
# Taxonomies of InfoSys Controls

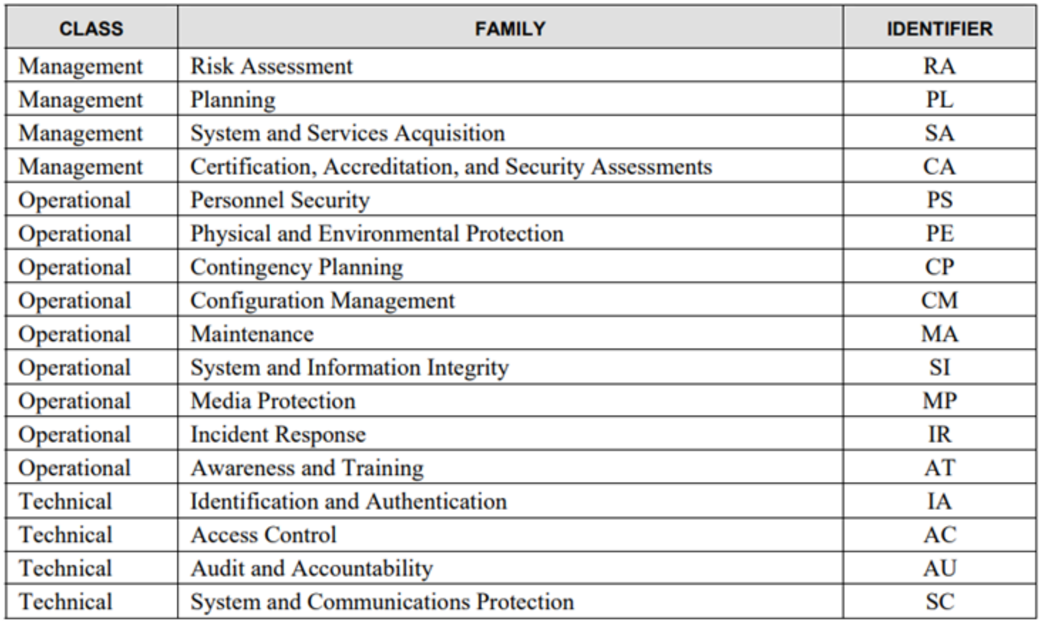
By Function

- Identify
- Protect
- Detect
- Respond
- Recover

By Class

- Management
- Operational
- Technical





| CLASS | FAMILY | IDENTIFIER |
|---|---|---|
| Management | Risk Assessment | RA |
| Management | Planning | PL |
| Management | System and Services Acquisition | SA |
| Management | Certification, Accreditation, and Security Assessments | CA |
| Operational | Personnel Security | PS |
| Operational | Physical and Environmental Protection | PE |
| Operational | Contingency Planning | CP |
| Operational | Configuration Management | CM |
| Operational | Maintenance | MA |
| Operational | System and Information Integrity | SI |
| Operational | Media Protection | MP |
| Operational | Incident Response | IR |
| Operational | Awareness and Training | AT |
| Technical | Identification and Authentication | IA |
| Technical | Access Control | AC |
| Technical | Audit and Accountability | AU |
| Technical | System and Communications Protection | SC |

# Taxonomies of InfoSys Controls

## *By <u>Modality</u>*

1. Physical
2. Technical
3. Administrative

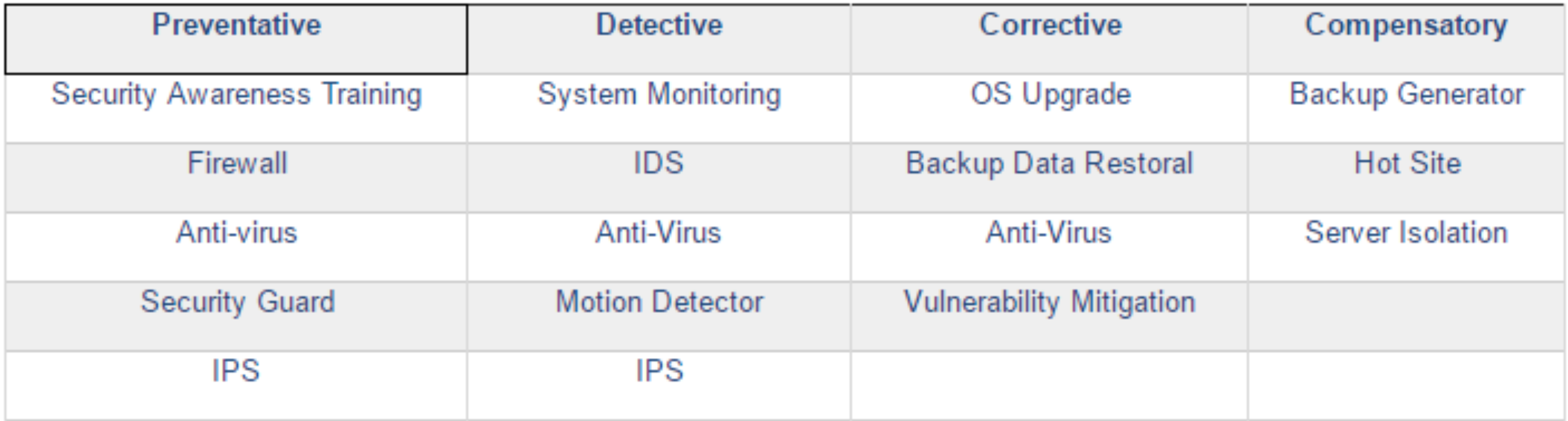
*A modality is the way (or mode) in which something is done*

http://www.sans.edu/research/security-laboratory/article/security-controls

# Taxonomies of InfoSys Controls

## *By <u>Phase</u>*

1. Preventative
2. Detective
3. Corrective



| Preventative | Detective | Corrective | Compensatory |
|---|---|---|---|
| Security Awareness Training | System Monitoring | OS Upgrade | Backup Generator |
| Firewall | IDS | Backup Data Restoral | Hot Site |
| Anti-virus | Anti-Virus | Anti-Virus | Server Isolation |
| Security Guard | Motion Detector | Vulnerability Mitigation | |
| IPS | IPS | | |

These are sometimes referred to as "*phase controls*"

http://www.sans.edu/research/security-laboratory/article/security-controls

# Taxonomies of InfoSys Controls

By <u>function</u>

- Preventive
- Detective
- Corrective
- Compensating

By <u>modality</u>

- Physical
- Technical
- Administrative

# *Juxtaposing taxonomies to improve understanding…*

| | | Modality | | |
|---|---|---|---|---|
| | **Controls** | **Administrative** | **Technical** | **Physical** |
| **Function** | **Preventive** | *User registration* | *Passwords, Tokens* | *Fences* |
| | **Detective** | *Report reviews* | *Audit Logs* | *Sensors* |
| | **Corrective** | *Employee termination* | *Connection management* | *Fire extinguisher* |
| | **Compensating** | *Supervision* | *Keystroke logging* | *Layered defenses* |

# Question

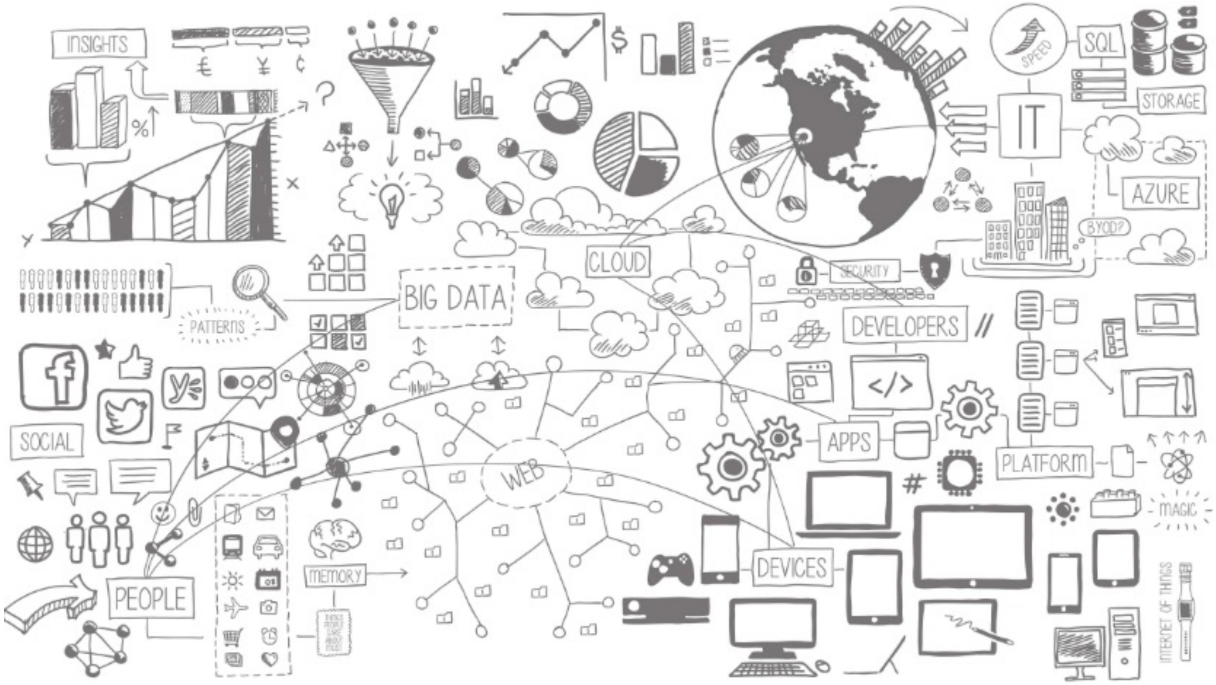
- What is data ?
- What is information ?
- How do data  and information relate to each other?
- What is an information system?

# What is data ?

http://researchdata.ox.ac.uk/

1. Known facts or things used as a basis for inference or reckoning
2. Quantities or characters operated on by a computer etc.

The Concise Oxford Dictionary



https://blogs.microsoft.com/blog/2014/04/15/a-data-culture-for-everyone/

*What is the nature of data stored in the attributes comprising the entities within the information system's databases*

# What is information?

*An Entity's attribute values can be understood in terms of* ***"measurement levels"***

*Stevens, S.S. 1946. On the theory of scales of measurement. Science 103:677-680.*

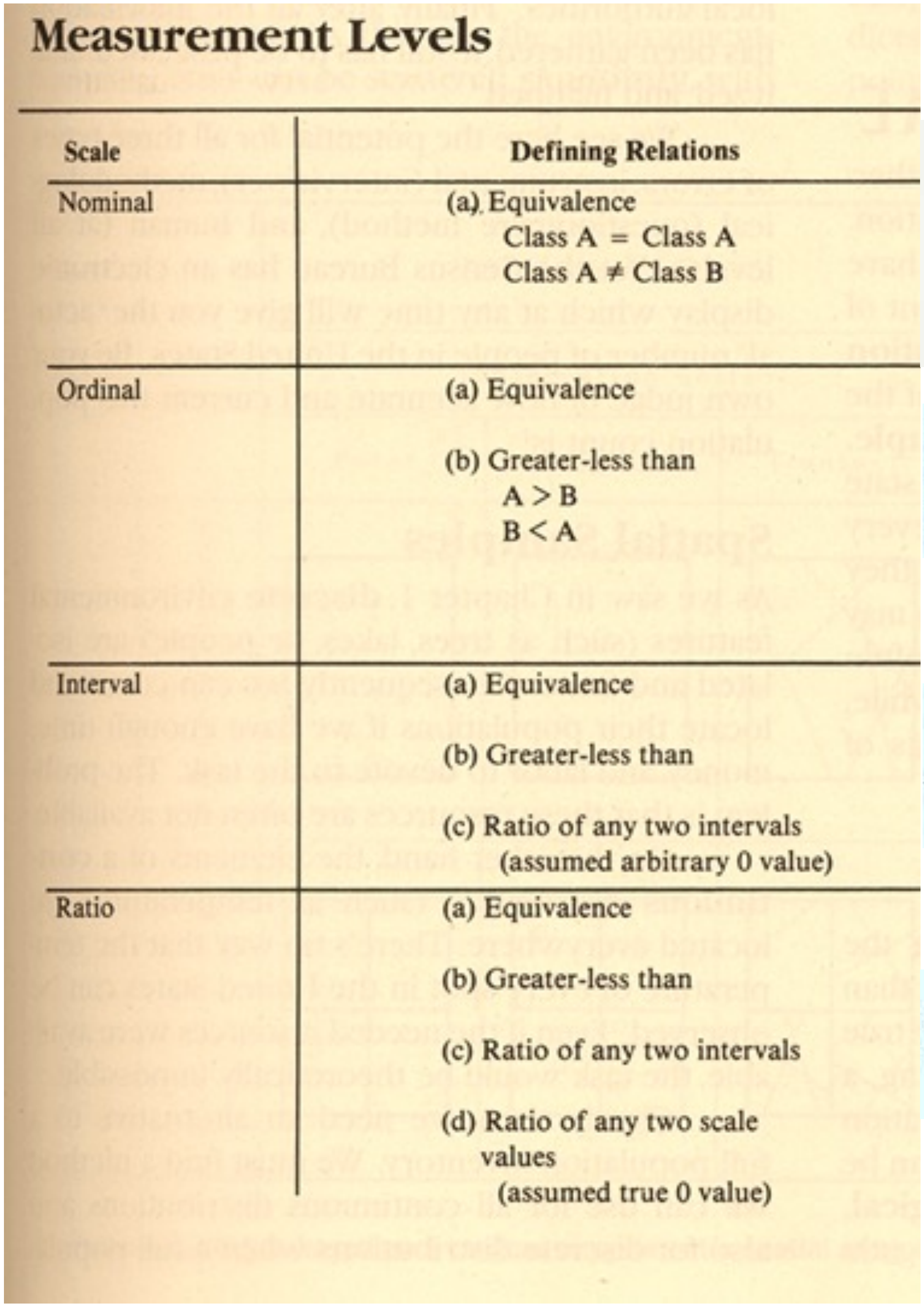
Measurements levels describe the inherent nature of information in the attribute data that make up entities

- Qualitative information tells what things exist
- Quantitative information orders and measures the magnitude of these things

**Steven's 4 measurement levels**

1. Nominal
2. Ordinal
3. Interval
4. Ratio

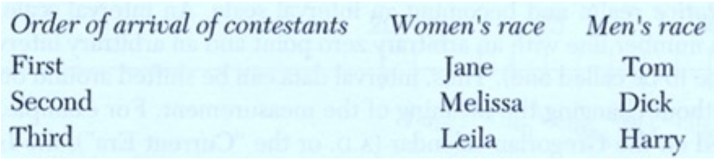
Increasing information content



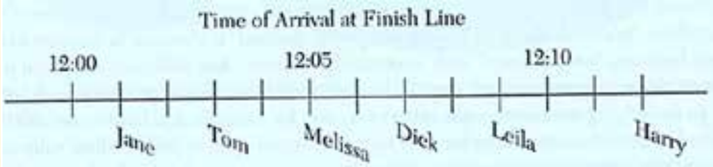
## Measurement Levels

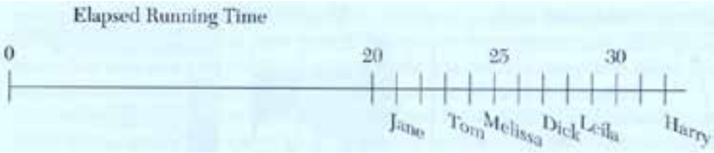
| Scale | Defining Relations |
|---|---|
| Nominal | (a) Equivalence<br>Class A = Class A<br>Class A ≠ Class B |
| Ordinal | (a) Equivalence<br>(b) Greater-less than<br>A > B<br>B < A |
| Interval | (a) Equivalence<br>(b) Greater-less than<br>(c) Ratio of any two intervals<br>(assumed arbitrary 0 value) |
| Ratio | (a) Equivalence<br>(b) Greater-less than<br>(c) Ratio of any two intervals<br>(d) Ratio of any two scale values<br>(assumed true 0 value) |

Polka dot
Solid Color



| *Order of arrival of contestants* | *Women's race* | *Men's race* |
|---|---|---|
| First | Jane | Tom |
| Second | Melissa | Dick |
| Third | Leila | Harry |

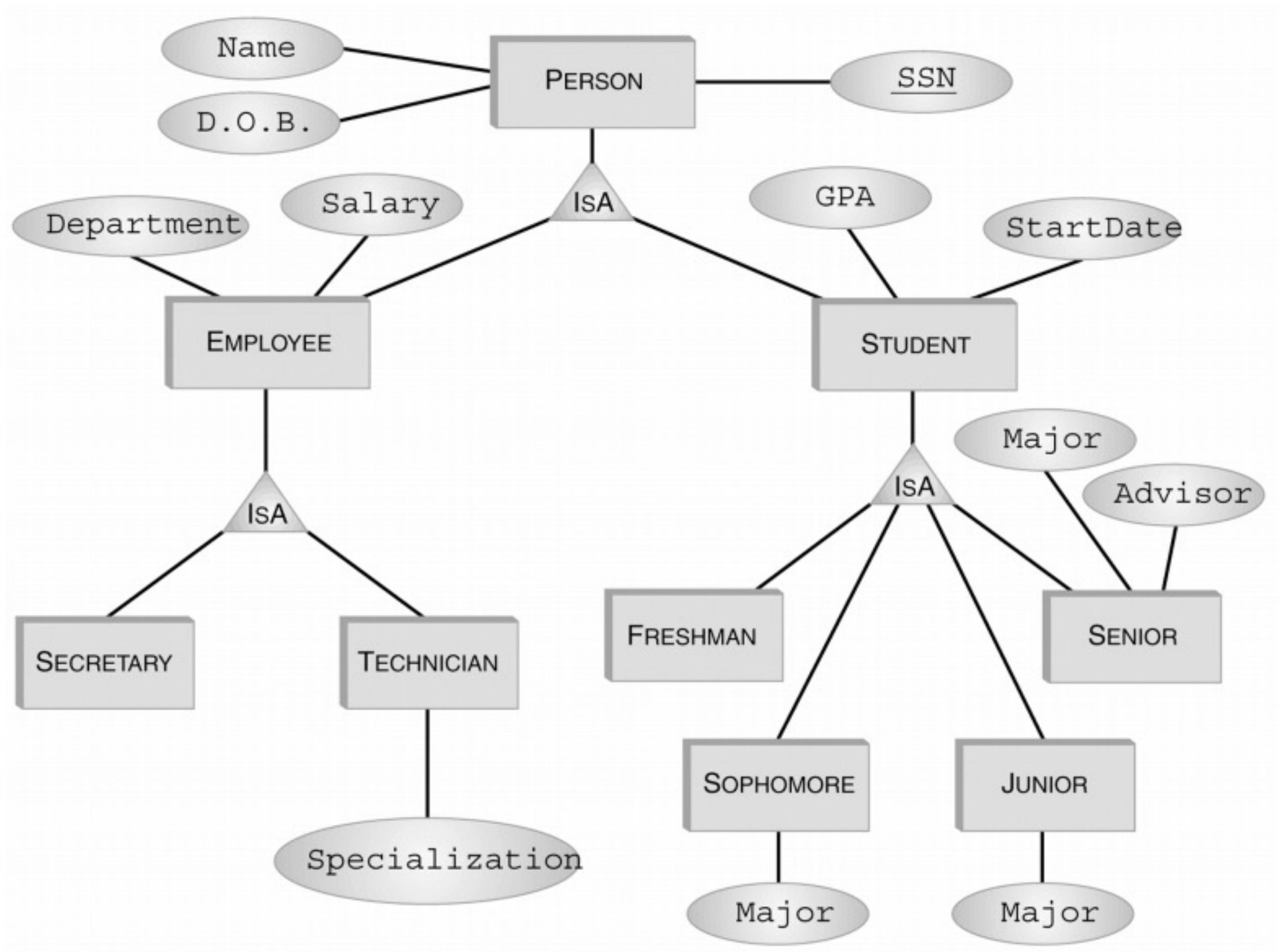




# Entity Attribute Value Measurement Types

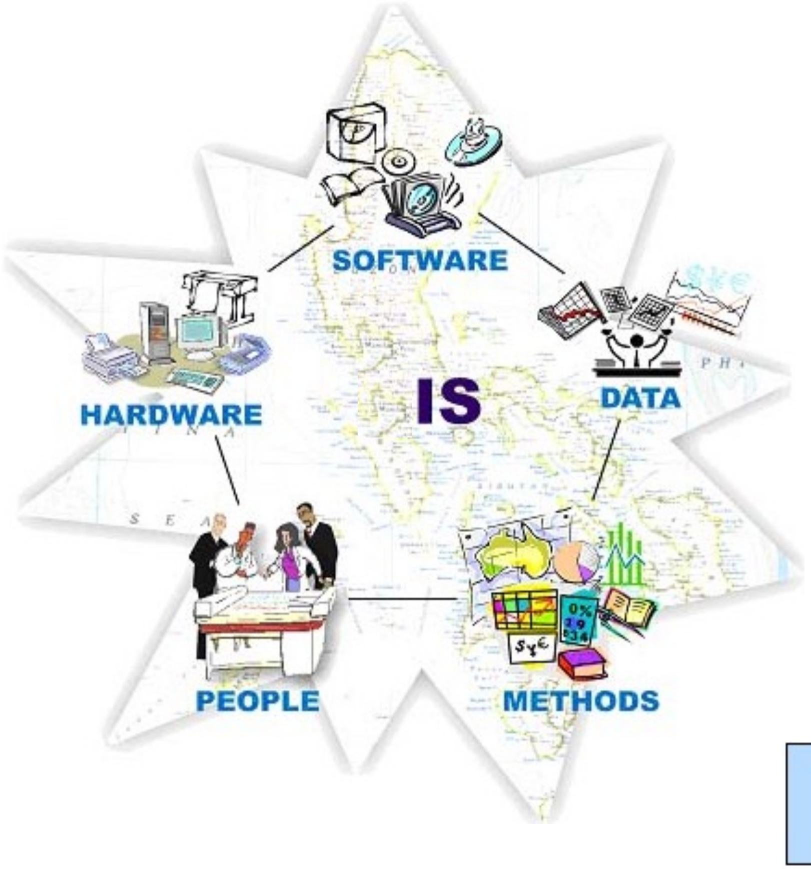
| | **Qualitative** | **Quantitative** |
|---|---|---|
| Nominal | X | |
| Ordinal | X | |
| Interval | | X |
| Ratio | | X |

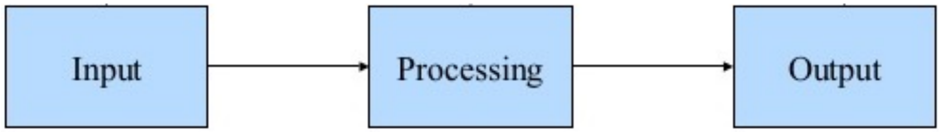
# How would you use Steven's measurements levels to categorize this information ?



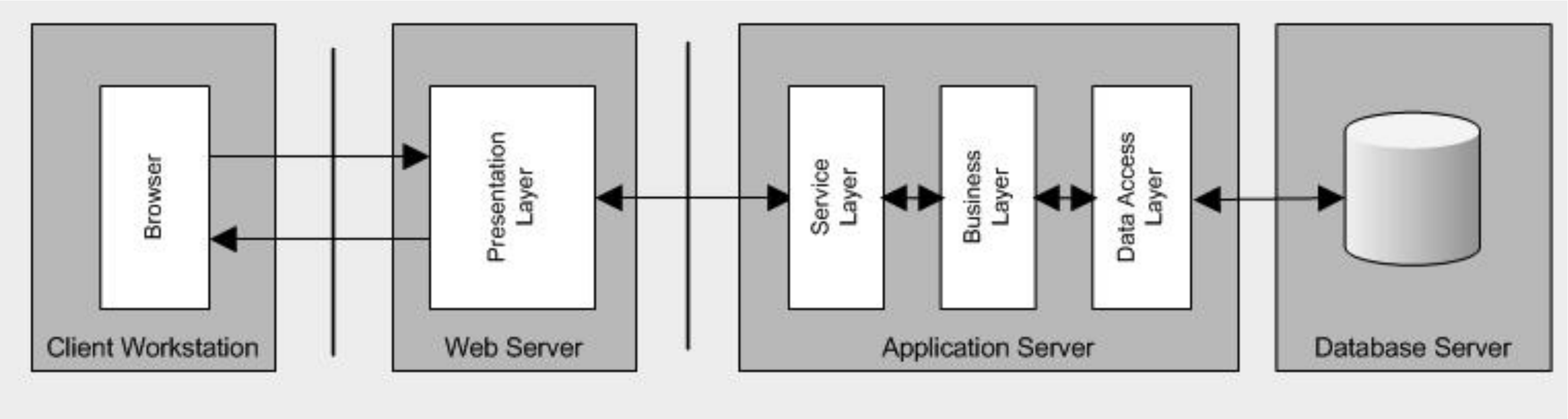
# What is an information system

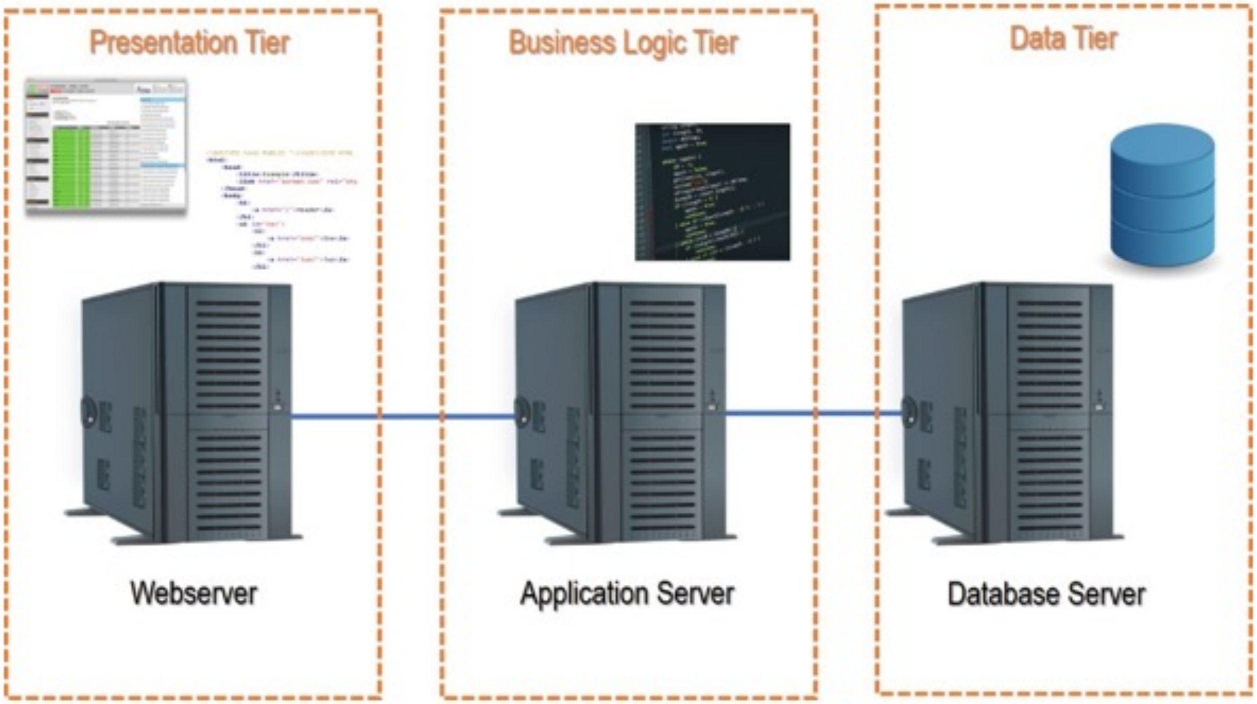
“An **information system** (**IS**) is an organized system for the collection, organization, storage and communication of information. …complementary networks that people and organizations use to collect, filter (query), process, create and distribute data. Further, an information system (IS) is a group of components that interact to produce information.” Wikepedia



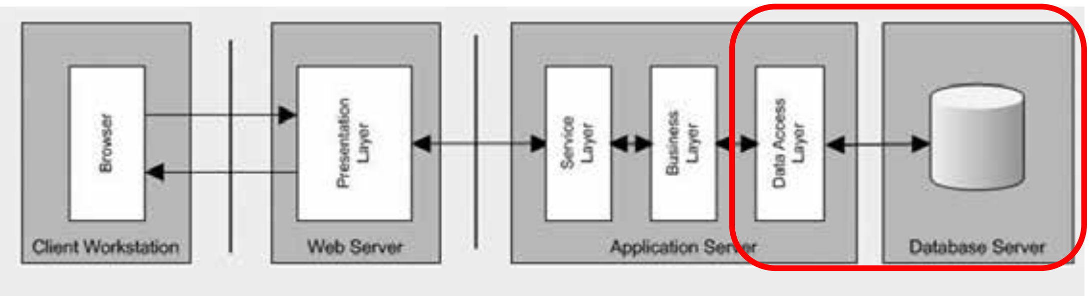


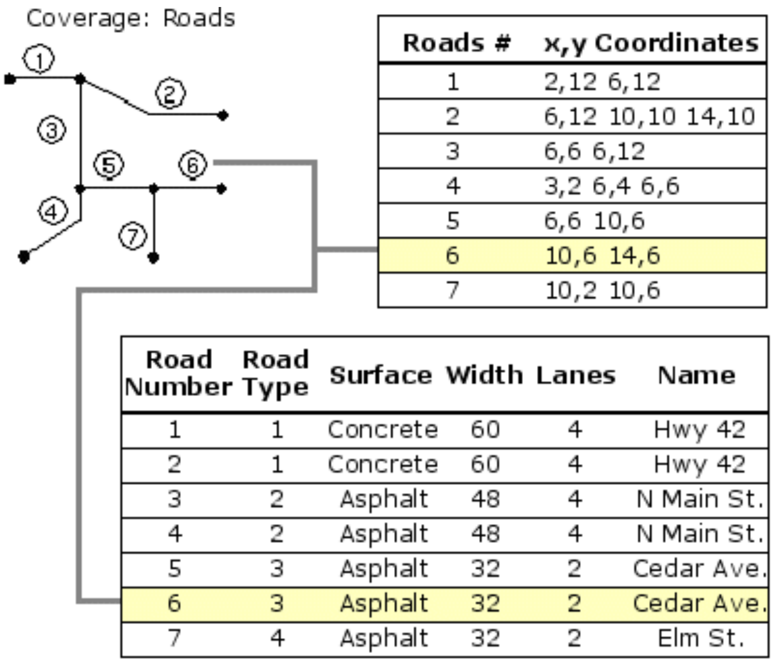
# Information system (IS) architectures





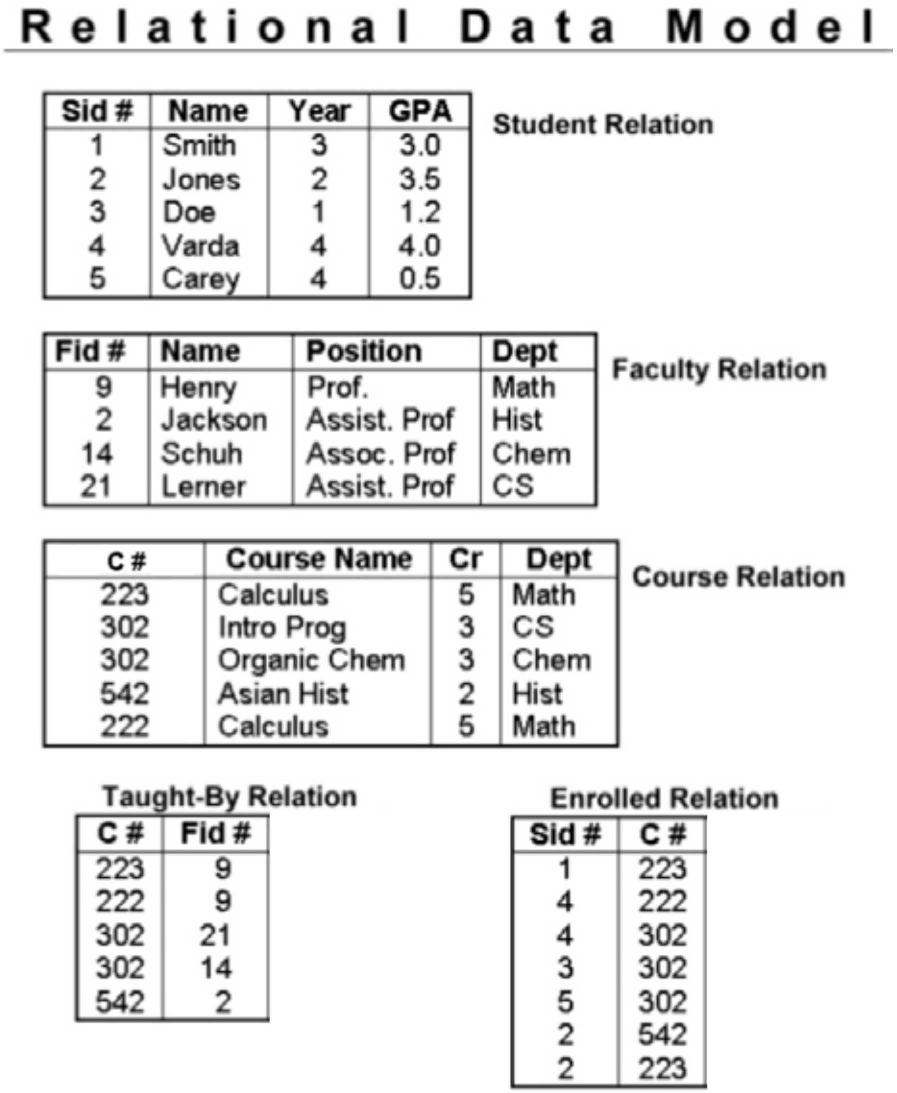
# Information System Data





| Roads # | x,y Coordinates |
|---|---|
| 1 | 2,12 6,12 |
| 2 | 6,12 10,10 14,10 |
| 3 | 6,6 6,12 |
| 4 | 3,2 6,4 6,6 |
| 5 | 6,6 10,6 |
| 6 | 10,6 14,6 |
| 7 | 10,2 10,6 |

| Road Number | Road Type | Surface | Width | Lanes | Name |
|---|---|---|---|---|---|
| 1 | 1 | Concrete | 60 | 4 | Hwy 42 |
| 2 | 1 | Concrete | 60 | 4 | Hwy 42 |
| 3 | 2 | Asphalt | 48 | 4 | N Main St. |
| 4 | 2 | Asphalt | 48 | 4 | N Main St. |
| 5 | 3 | Asphalt | 32 | 2 | Cedar Ave. |
| 6 | 3 | Asphalt | 32 | 2 | Cedar Ave. |
| 7 | 4 | Asphalt | 32 | 2 | Elm St. |



## Relational Data Model

Student Relation

| Sid # | Name | Year | GPA |
|---|---|---|---|
| 1 | Smith | 3 | 3.0 |
| 2 | Jones | 2 | 3.5 |
| 3 | Doe | 1 | 1.2 |
| 4 | Varda | 4 | 4.0 |
| 5 | Carey | 4 | 0.5 |

Faculty Relation

| Fid # | Name | Position | Dept |
|---|---|---|---|
| 9 | Henry | Prof. | Math |
| 2 | Jackson | Assist. Prof | Hist |
| 14 | Schuh | Assoc. Prof | Chem |
| 21 | Lerner | Assist. Prof | CS |

Course Relation

| C # | Course Name | Cr | Dept |
|---|---|---|---|
| 223 | Calculus | 5 | Math |
| 302 | Intro Prog | 3 | CS |
| 302 | Organic Chem | 3 | Chem |
| 542 | Asian Hist | 2 | Hist |
| 222 | Calculus | 5 | Math |

Taught-By Relation

| C # | Fid # |
|---|---|
| 223 | 9 |
| 222 | 9 |
| 302 | 21 |
| 302 | 14 |
| 542 | 2 |

Enrolled Relation

| Sid # | C # |
|---|---|
| 1 | 223 |
| 4 | 222 |
| 4 | 302 |
| 3 | 302 |
| 5 | 302 |
| 2 | 542 |
| 2 | 223 |

# Concept

*Classification* Grouping of data according to pre-determined types

*Why classify data ?*

# Data Classification Processes and Models

*Data classification ("categorization") is essential to ensuring that data is appropriately protected, and done so in the most cost-effective manner*

*The goal is to classify data according to risk associated with a breach to their confidentiality, integrity, and availability*

*Enables determining the appropriate cost expenditure of security control mitigations required to protect the IT assets*

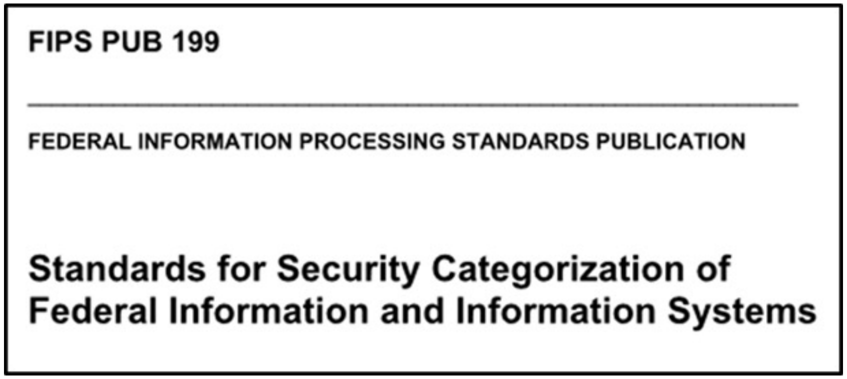
# Key Concepts

| | |
|---|---|
| *Classification* | Grouping of data according to pre-determined types |
| *Cost-Effectiveness* | Appropriateness of the level of risk mitigation expenditure |
| *Confidentiality* | Restriction who may know about and/or have access to information |
| *Integrity* | Confidence that information is complete and unaltered |
| *Availability* | Access to information |

# Question:

*How should we determine the information security categorization of an IT asset?*

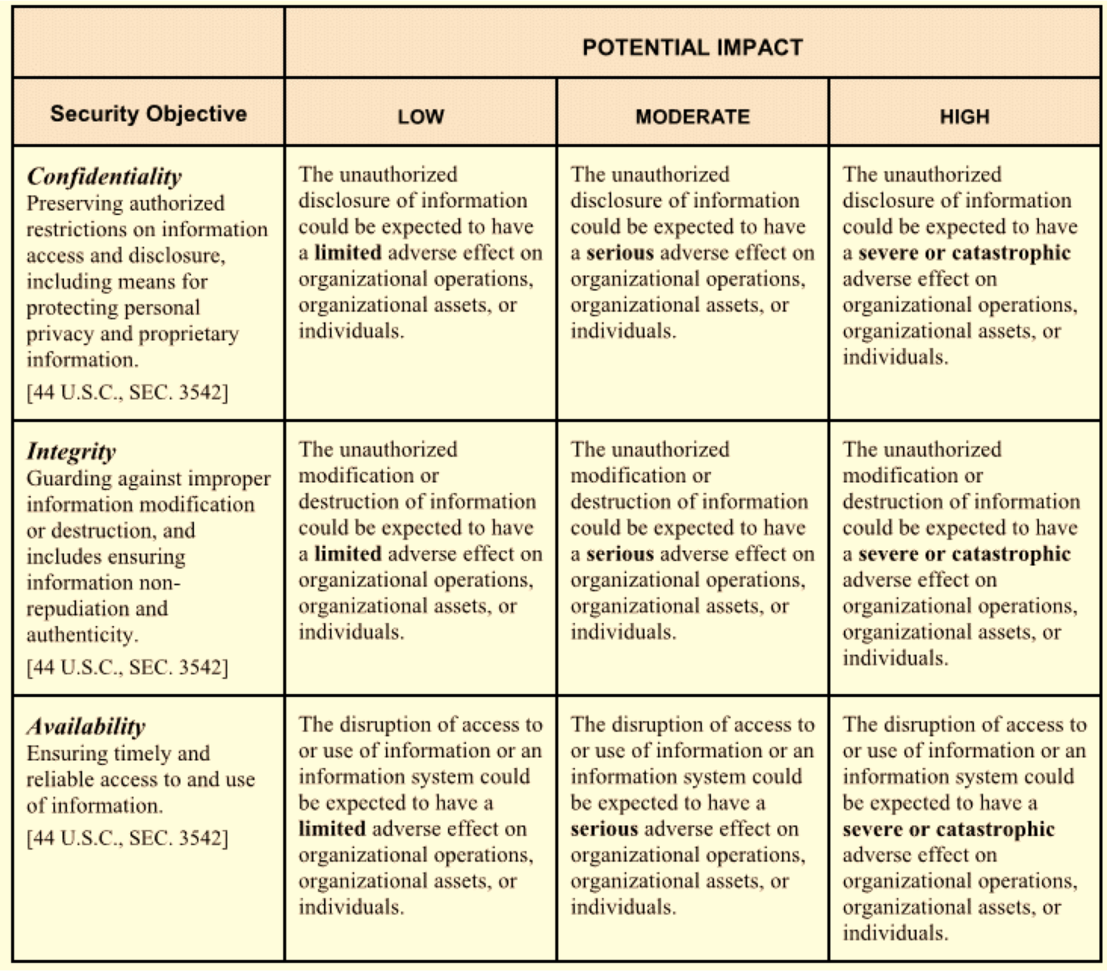
# FIPS 199 Standards: Security objectives and impact ratings



FIPS PUB 199

FEDERAL INFORMATION PROCESSING STANDARDS PUBLICATION

**Standards for Security Categorization of Federal Information and Information Systems**



| | POTENTIAL IMPACT | | |
|---|---|---|---|
| **Security Objective** | **LOW** | **MODERATE** | **HIGH** |
| ***Confidentiality***<br>Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information.<br>[44 U.S.C., SEC. 3542] | The unauthorized disclosure of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals. | The unauthorized disclosure of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals. | The unauthorized disclosure of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals. |
| ***Integrity***<br>Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity.<br>[44 U.S.C., SEC. 3542] | The unauthorized modification or destruction of information could be expected to have a **limited** adverse effect on organizational operations, organizational assets, or individuals. | The unauthorized modification or destruction of information could be expected to have a **serious** adverse effect on organizational operations, organizational assets, or individuals. | The unauthorized modification or destruction of information could be expected to have a **severe or catastrophic** adverse effect on organizational operations, organizational assets, or individuals. |
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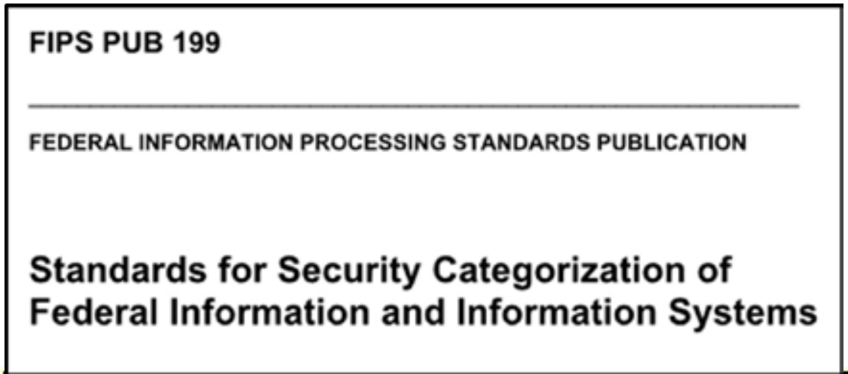
***Low:*** *Limited adverse effect*

***Moderate:*** *Serious adverse effect*

***High:*** *Severe or catastrophic adverse effect*

Confidentiality
Integrity
CIA
TRIAD
Availability



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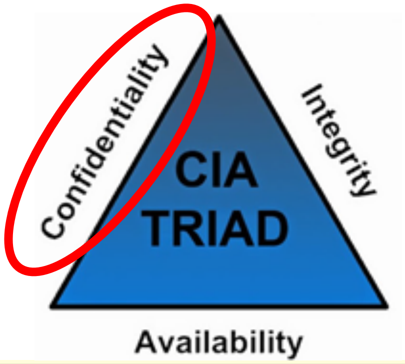

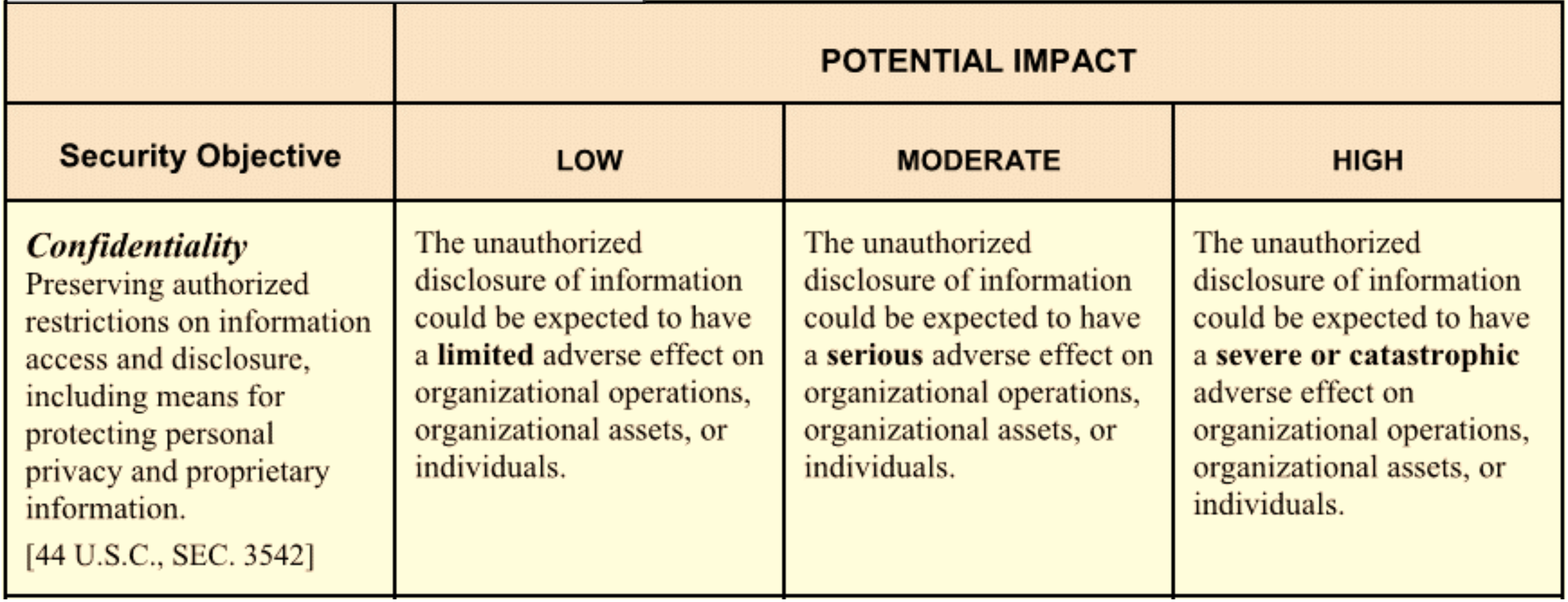

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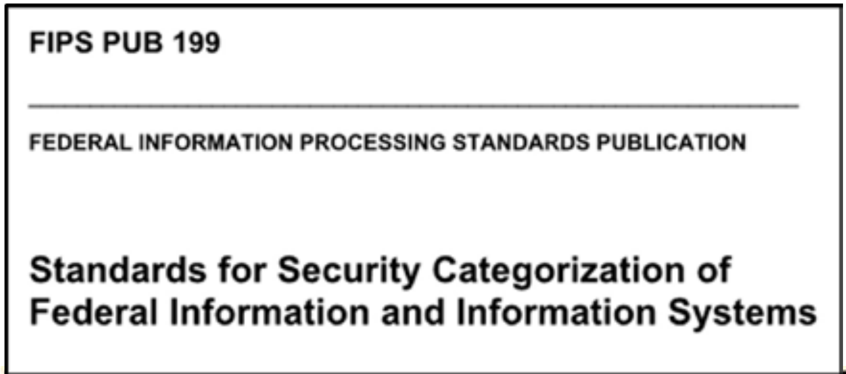

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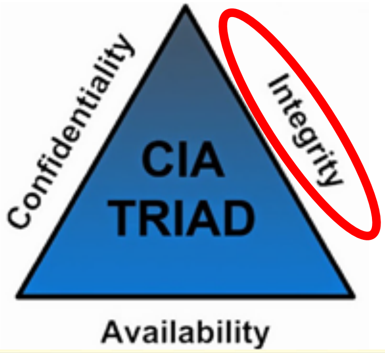

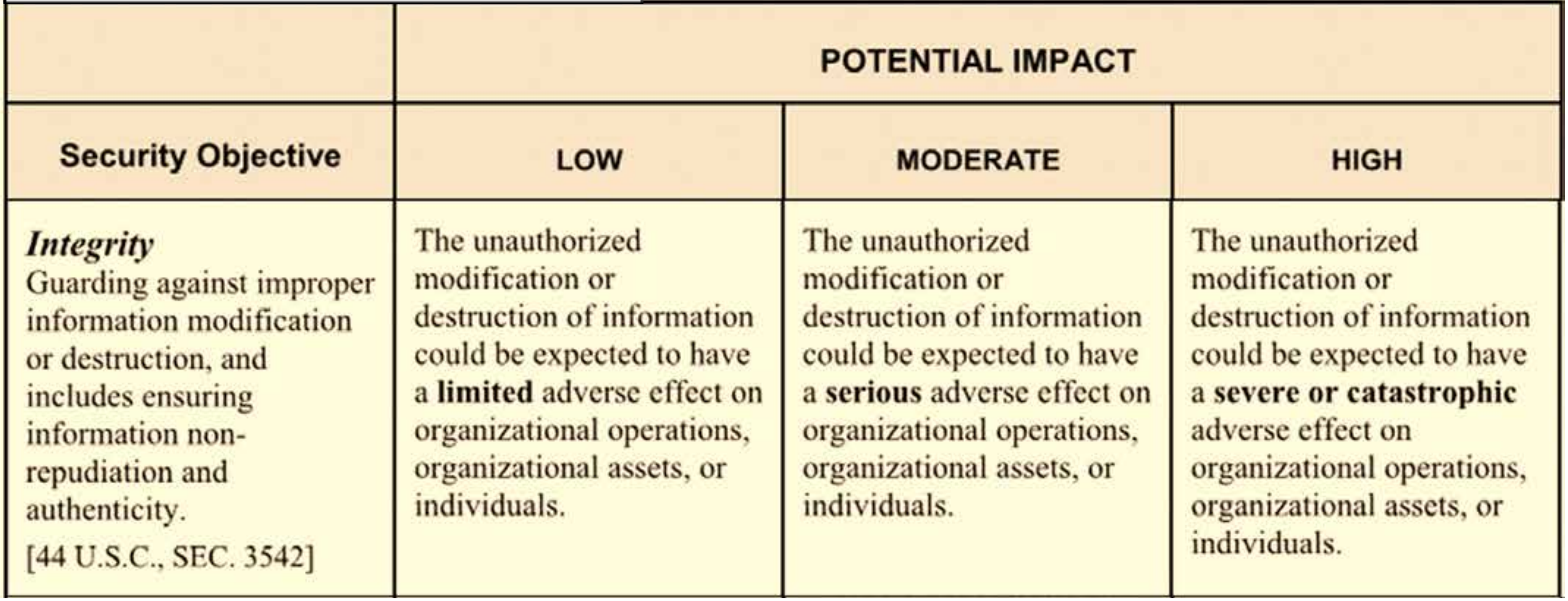

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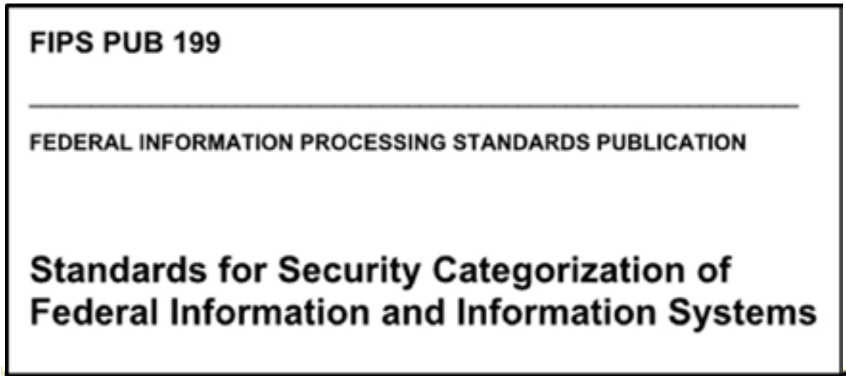

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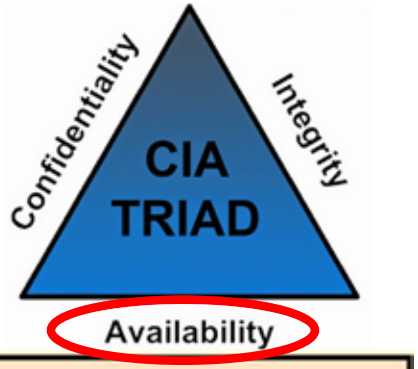

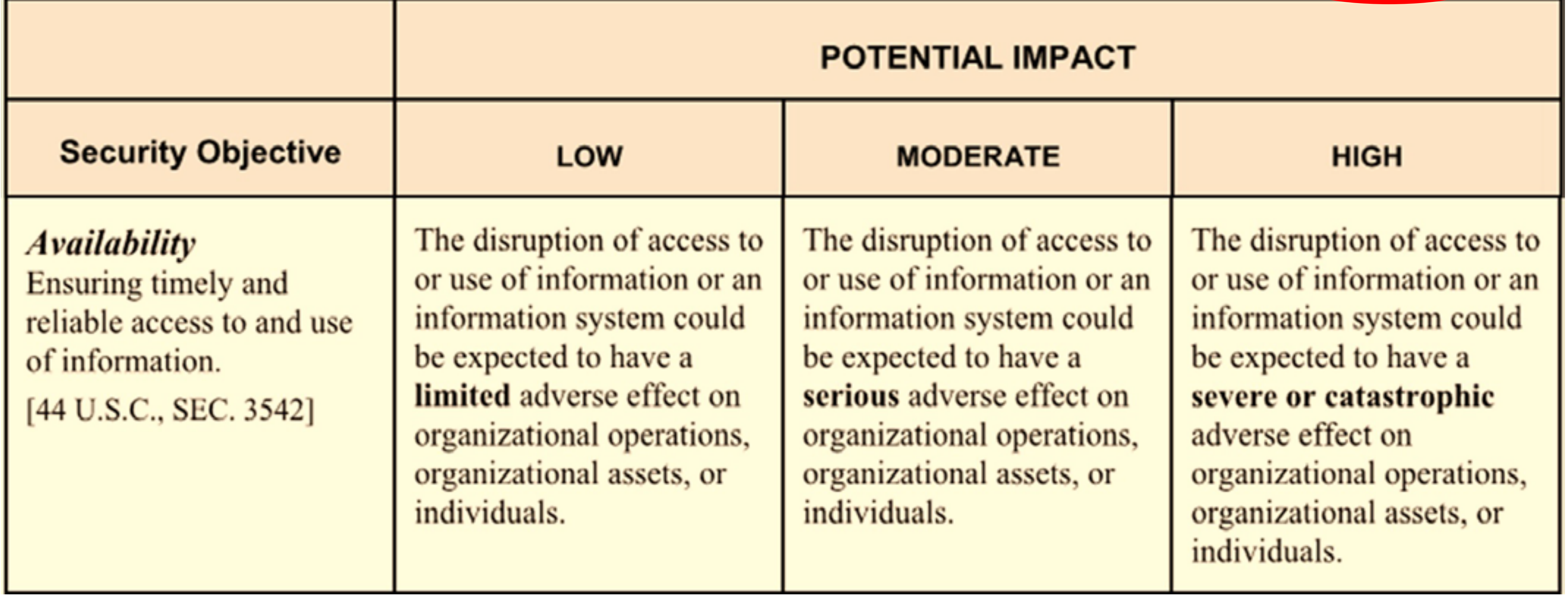

|  | POTENTIAL IMPACT |  |  |
|---|---|---|---|
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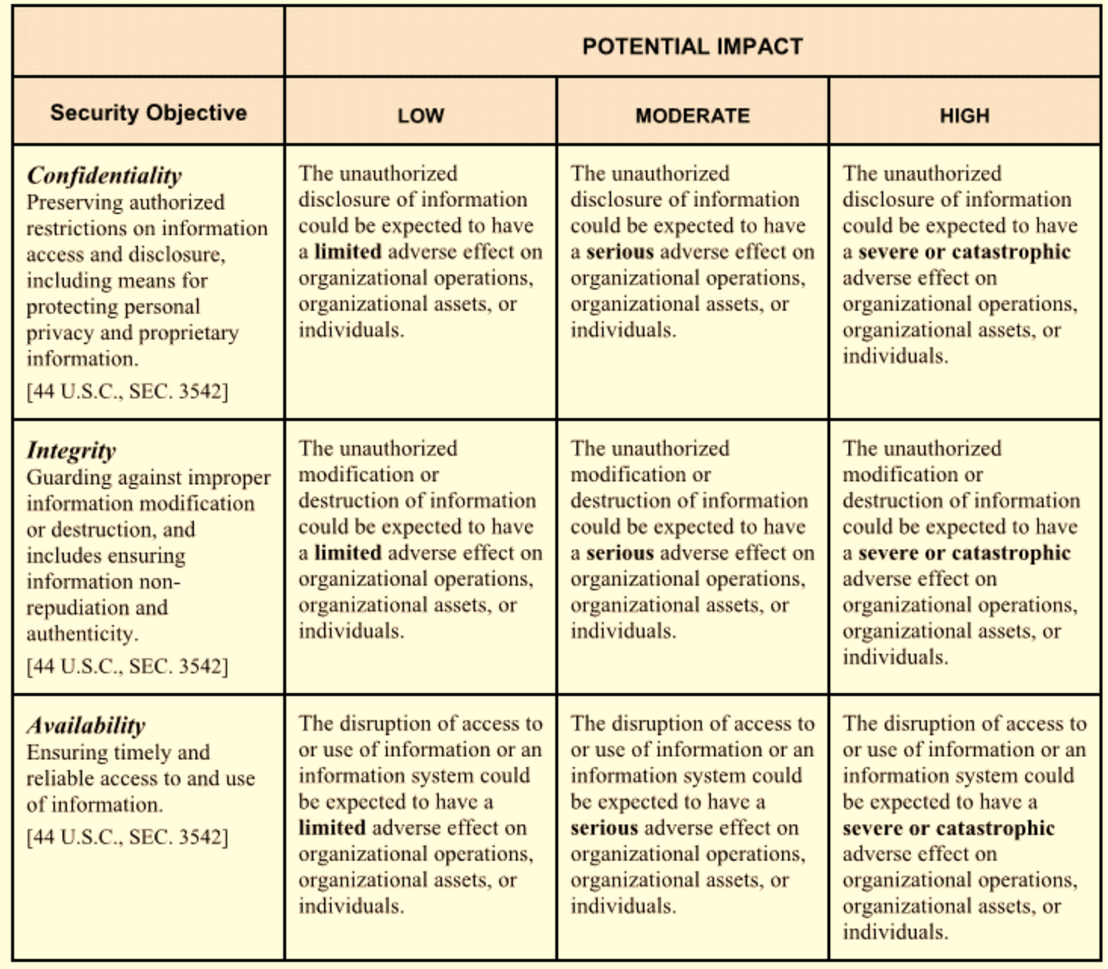
# **FIPS 199** standard: Security objectives and impact ratings

***Low:*** *Limited adverse effect*

***Moderate:*** *Serious adverse effect*

***High:*** *Severe or catastrophic adverse effect*

*What kind of Steven's measurement level is used by the FIPS 199 Information Security categorization standard?*



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# Team Project Schedule

Preparation begins

Preparation continues

Presentations

Presentations

| Unit | Assignment Topics |
|---|---|
| 1 | Introduction to MIS5206 |
| | Understanding an Organization's Risk Environment |
| 2 | Case Study 1: *Snowfall and a stolen laptop* |
| | Data Classification Process and Models |
| 3 | Risk Evaluation |
| 4 | Case Study 2: *Autopsy of a Data Breach: The Target Case* |
| 5 | Creating a Security Aware Organization |
| 6 | Physical and Environmental Security |
| 7 | **Midterm Exam** |
| 8 | Case Study 3: *A Hospital Catches the "Millennium Bug"* |
| 9 | Business Continuity and Disaster Recovery Planning |
| 10 | Network Security |
| 11 | Cryptography, Public Key Encryption and Digital Signatures |
| 12 | Identity Management and Access Control |
| 13 | Computer Application Security |
| | Team Project Presentations |
| 14 | Team Project Presentations |
| | Review |
| 15 | **Final Exam** |

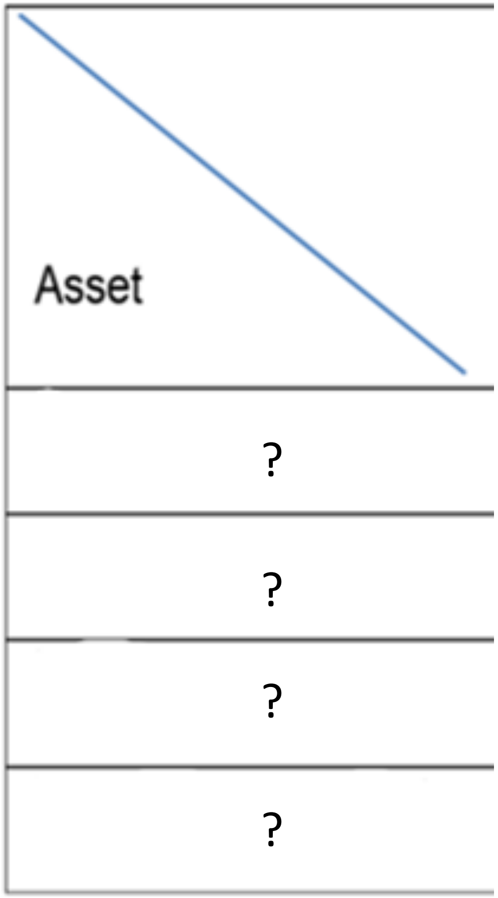
# Question:

*How do you determine the information security categorization of each dataset on the Dean's computer?*

***Exercise:***

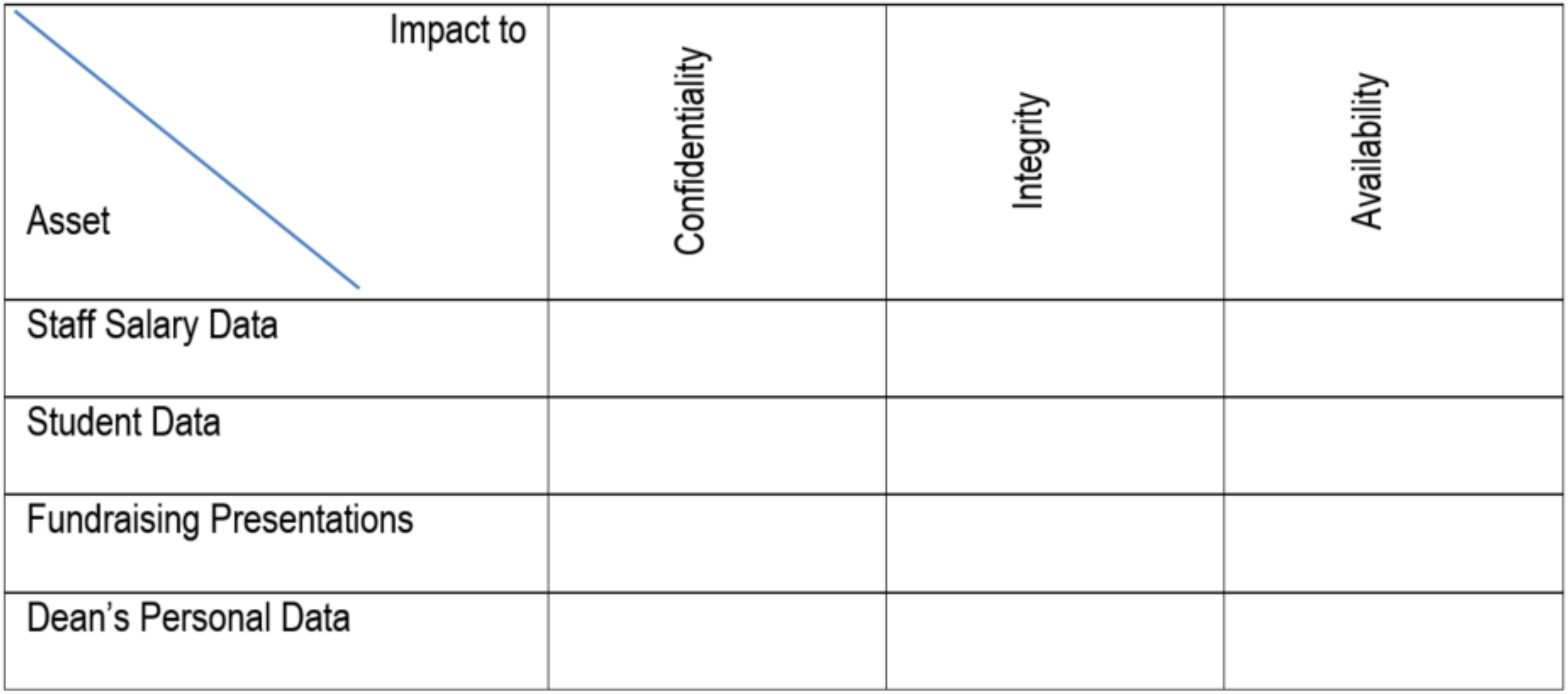
1. *Inventory the (possible) types of information that might be on the Dean's laptop*
2. *Assign information security categorizations to the information contained on the Dean's laptop*
3. *Provide an overall security categorization for the laptop*

# 1. Create an inventory of types of datasets possibly stored on the Dean’s laptop



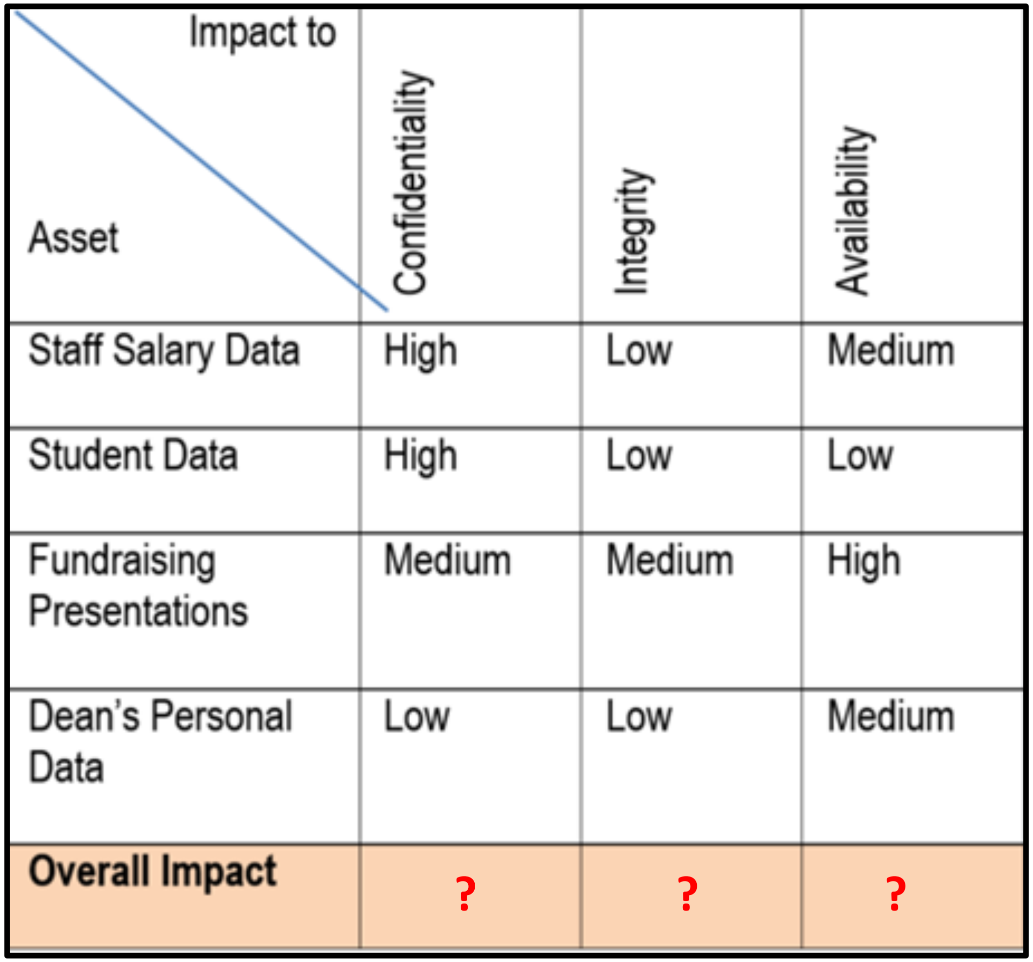
| Asset |
|---|
| ? |
| ? |
| ? |
| ? |

# 2. Assign information security categorization impact ratings to the data on the Dean’s laptop…



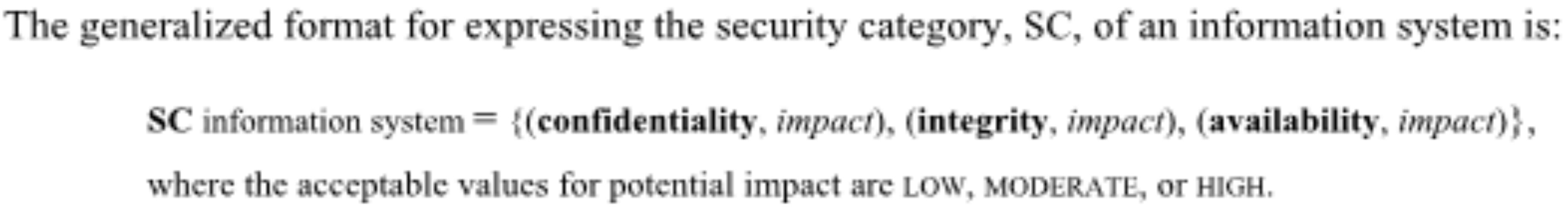
| Impact to<br>Asset | Confidentiality | Integrity | Availability |
|---|---|---|---|
| Staff Salary Data | | | |
| Student Data | | | |
| Fundraising Presentations | | | |
| Dean’s Personal Data | | | |

**What is the FIPS 199 information security categorization of the Dean's laptop?**



| Impact to<br>Asset | Confidentiality | Integrity | Availability |
|---|---|---|---|
| Staff Salary Data | High | Low | Medium |
| Student Data | High | Low | Low |
| Fundraising Presentations | Medium | Medium | High |
| Dean's Personal Data | Low | Low | Medium |
| **Overall Impact** | ? | ? | ? |

# FIPS Pub 199 Standard for determining the security categorization of an information system that contains or transports multiple information types

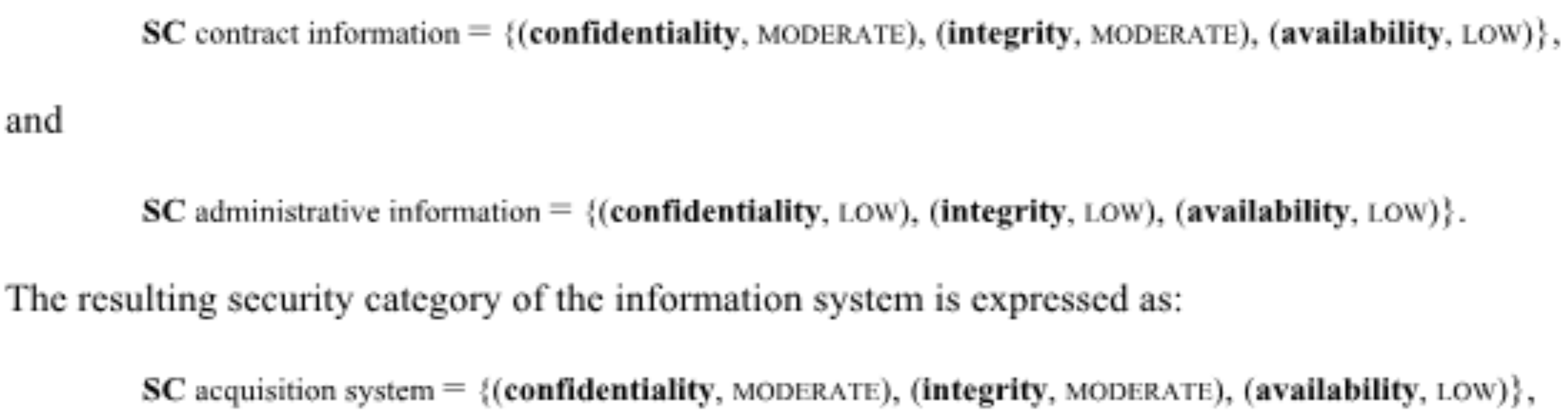


The generalized format for expressing the security category, SC, of an information system is:

**SC** information system = {(**confidentiality**, *impact*), (**integrity**, *impact*), (**availability**, *impact*)},

where the acceptable values for potential impact are LOW, MODERATE, or HIGH.

Example with multiple information types:



**SC** contract information = {(**confidentiality**, MODERATE), (**integrity**, MODERATE), (**availability**, LOW)},

and

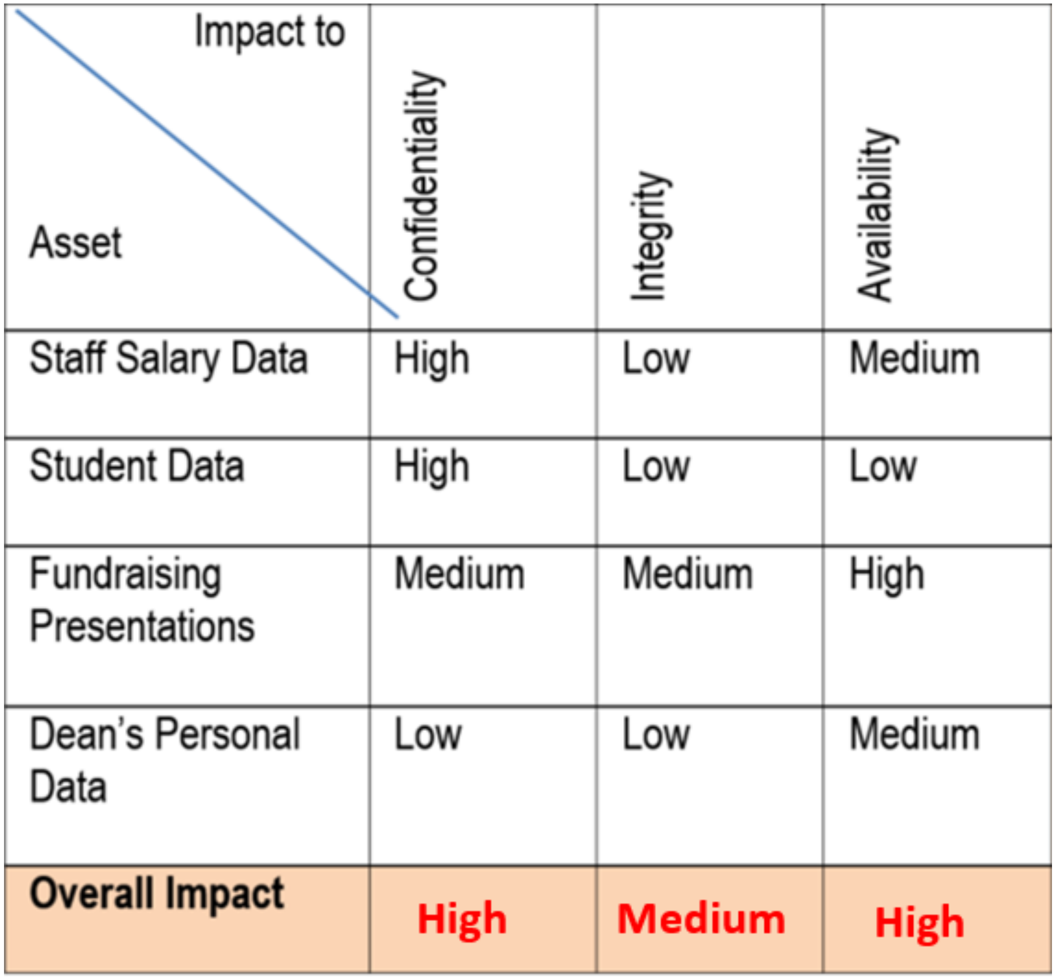
**SC** administrative information = {(**confidentiality**, LOW), (**integrity**, LOW), (**availability**, LOW)}.

The resulting security category of the information system is expressed as:

**SC** acquisition system = {(**confidentiality**, MODERATE), (**integrity**, MODERATE), (**availability**, LOW)},

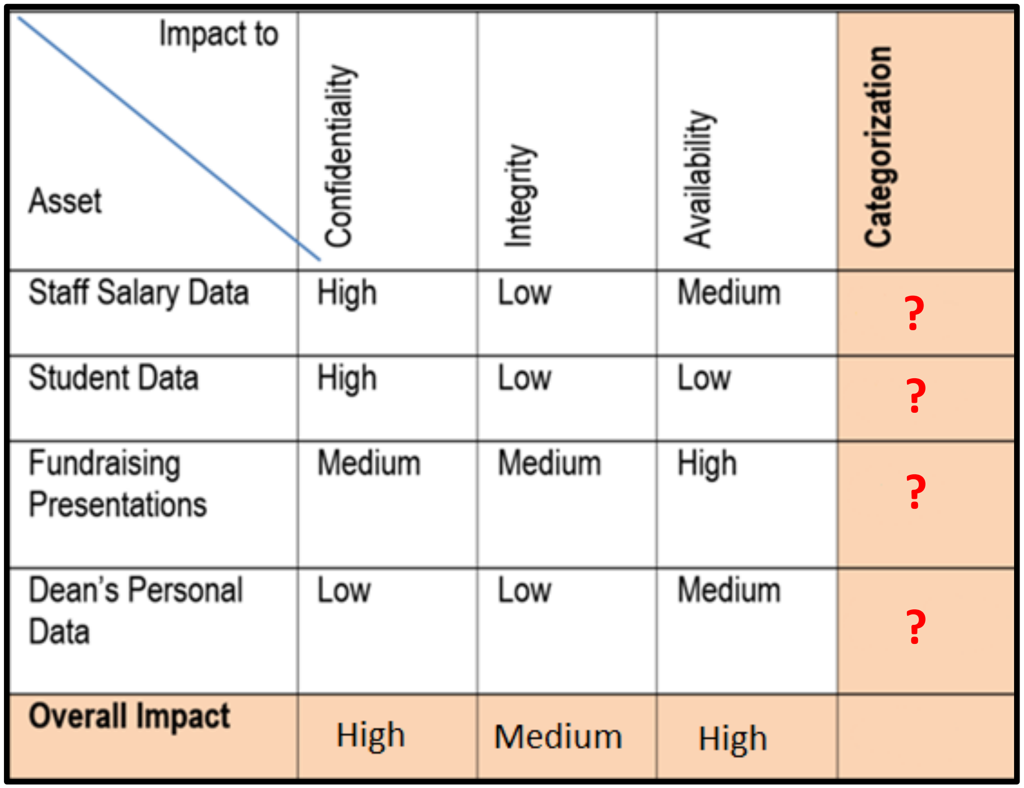
**Low:** Limited adverse effect
**Moderate:** Serious adverse effect
**High:** Severe or catastrophic adverse effect

**Overall impact in each of the CIA dimensions is based on the highest impact dataset in each of the dimensions**



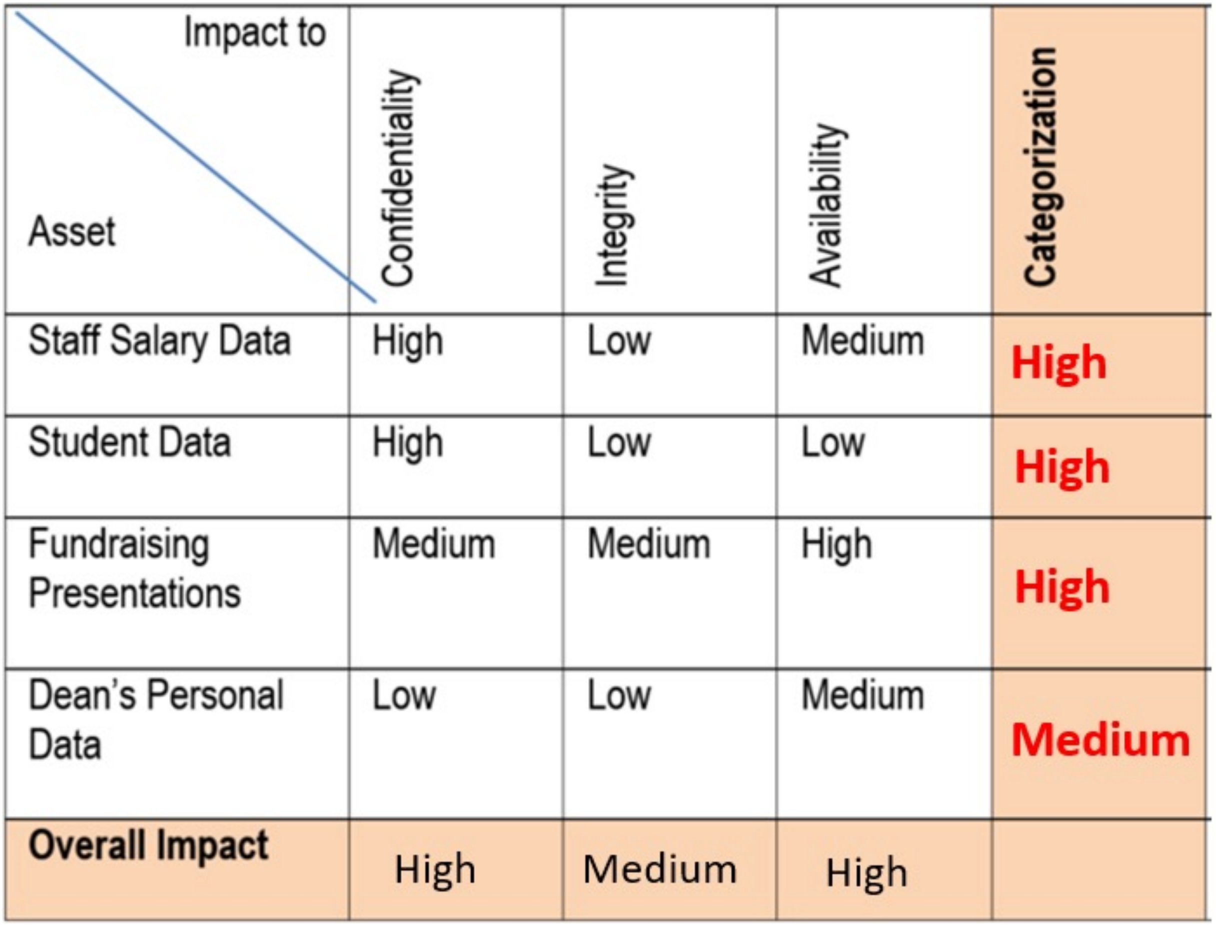
| Impact to<br>Asset | Confidentiality | Integrity | Availability |
|---|---|---|---|
| Staff Salary Data | High | Low | Medium |
| Student Data | High | Low | Low |
| Fundraising Presentations | Medium | Medium | High |
| Dean's Personal Data | Low | Low | Medium |
| **Overall Impact** | **High** | **Medium** | **High** |

## What single overall information security categorization would you give each dataset on the Dean's laptop?



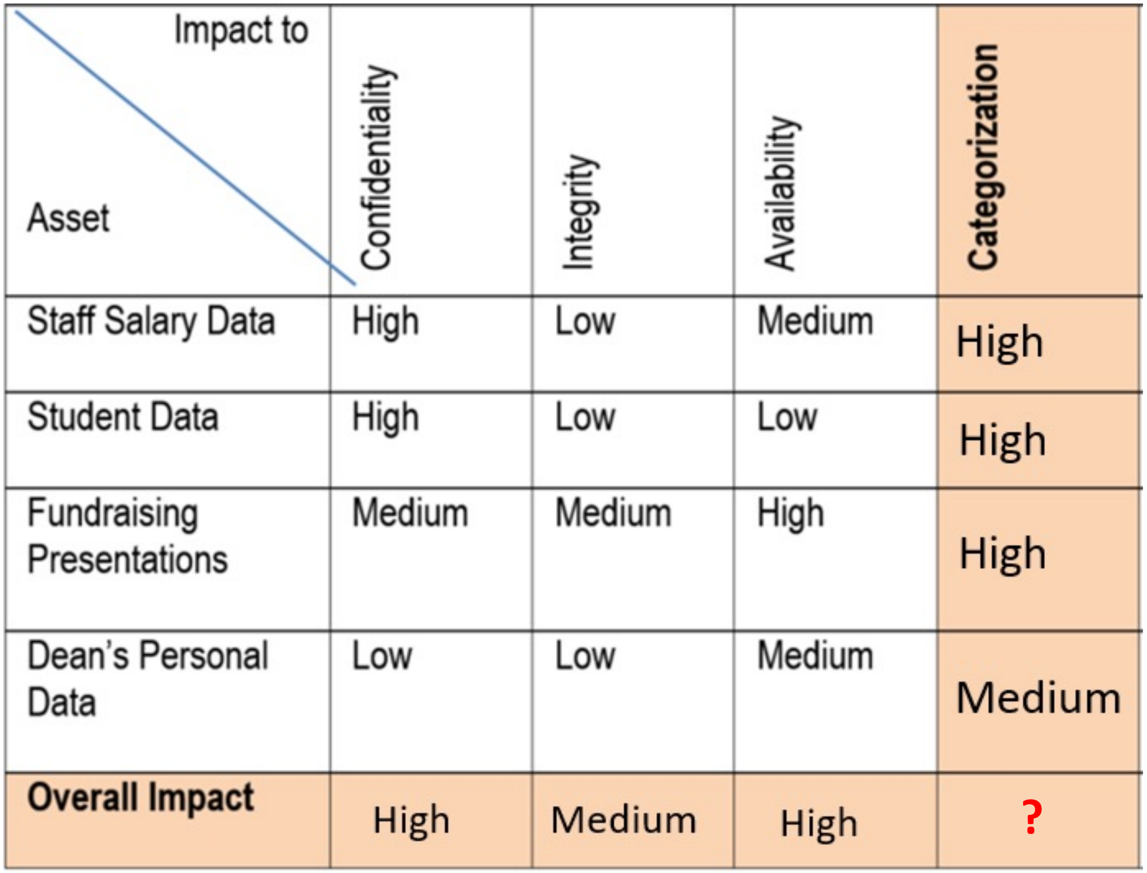
| Impact to<br>Asset | Confidentiality | Integrity | Availability | Categorization |
|---|---|---|---|---|
| Staff Salary Data | High | Low | Medium | ? |
| Student Data | High | Low | Low | ? |
| Fundraising Presentations | Medium | Medium | High | ? |
| Dean's Personal Data | Low | Low | Medium | ? |
| **Overall Impact** | High | Medium | High | |

## Single overall information security impact ratings for each dataset on the Dean’s laptop



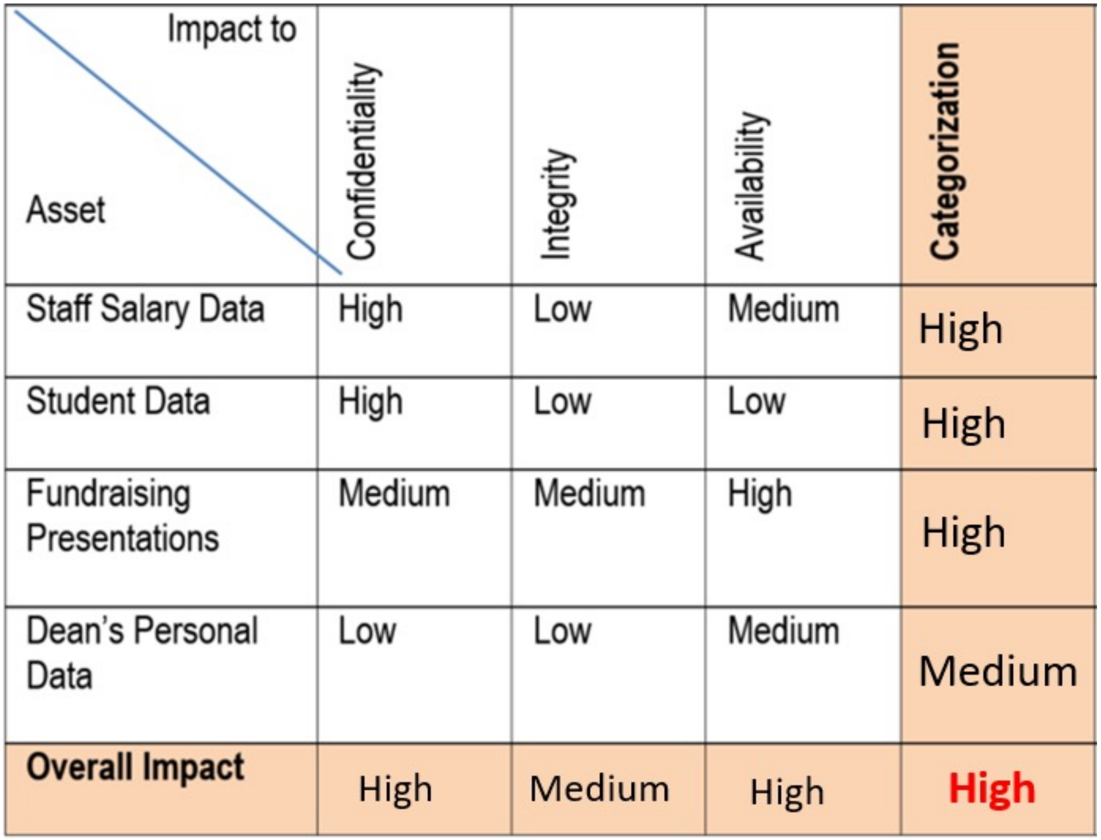
| Impact to<br>Asset | Confidentiality | Integrity | Availability | Categorization |
|---|---|---|---|---|
| Staff Salary Data | High | Low | Medium | High |
| Student Data | High | Low | Low | High |
| Fundraising Presentations | Medium | Medium | High | High |
| Dean’s Personal Data | Low | Low | Medium | Medium |
| **Overall Impact** | High | Medium | High | |

**What single value would you use to rate the information security requirements of the Dean’s laptop?**



| Impact to<br>Asset | Confidentiality | Integrity | Availability | **Categorization** |
|---|---|---|---|---|
| Staff Salary Data | High | Low | Medium | High |
| Student Data | High | Low | Low | High |
| Fundraising Presentations | Medium | Medium | High | High |
| Dean’s Personal Data | Low | Low | Medium | Medium |
| **Overall Impact** | High | Medium | High | ? |

**The single overall information security categorizations for each dataset on the Dean’s laptop**



| Impact to<br>Asset | Confidentiality | Integrity | Availability | **Categorization** |
|---|---|---|---|---|
| Staff Salary Data | High | Low | Medium | High |
| Student Data | High | Low | Low | High |
| Fundraising Presentations | Medium | Medium | High | High |
| Dean’s Personal Data | Low | Low | Medium | Medium |
| **Overall Impact** | High | Medium | High | **High** |

# How do you define and relate the following to each other?

- Policy
- Standard
- Guideline
- Procedure

# Policy, Standard, Guideline and Procedures

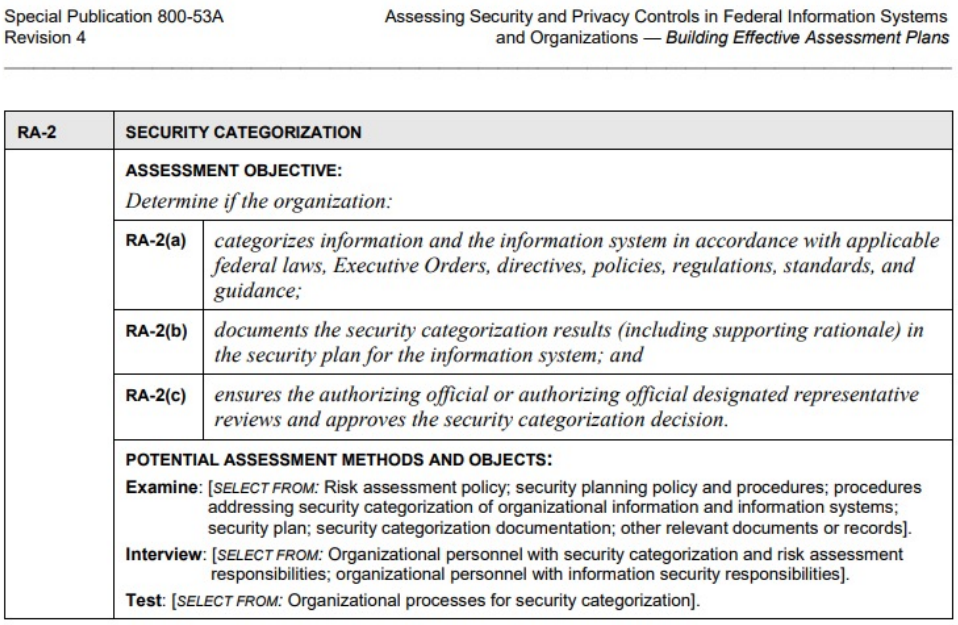
- **Policy:** A formal, brief, and high-level statement or plan that embraces an organization's general beliefs, goals, objectives, and acceptable procedures for a specified subject area. Policies always state required actions, and may include pointers to standards. Policy attributes include the following:
  - Requires compliance (mandatory)
  - Failure to comply results in disciplinary action
  - Focus on desired results, not on means of implementation
  - Further defined by standards and guidelines

- **Standard:** A mandatory action or rule designed to support and conform to a policy.
  - A standard should make a policy more meaningful and effective.
  - A standard must include one or more accepted specifications for hardware, software, or behavior.

- **Guideline:** General statements, recommendations, or administrative instructions designed to achieve the policy's objectives by providing a framework within which to implement procedures.
  - A guideline can change frequently based on the environment and should be reviewed more frequently than standards and policies.
  - A guideline is not mandatory, rather a suggestion of a best practice. Hence "guidelines" and "best practice" are interchangeable

- **Procedures:** Procedures describe the process: who does what, when they do it, and under what criteria. They can be text based or outlined in a process map.
  - A series of steps taken to accomplish an end goal.
  - Procedures define "how" to protect resources and are the mechanisms to enforce policy.
  - Procedures provide a quick reference in times of crisis.
  - Procedures help eliminate the problem of a single point of failure.
  - Also known as a SOP (Standard Operating Procedure)

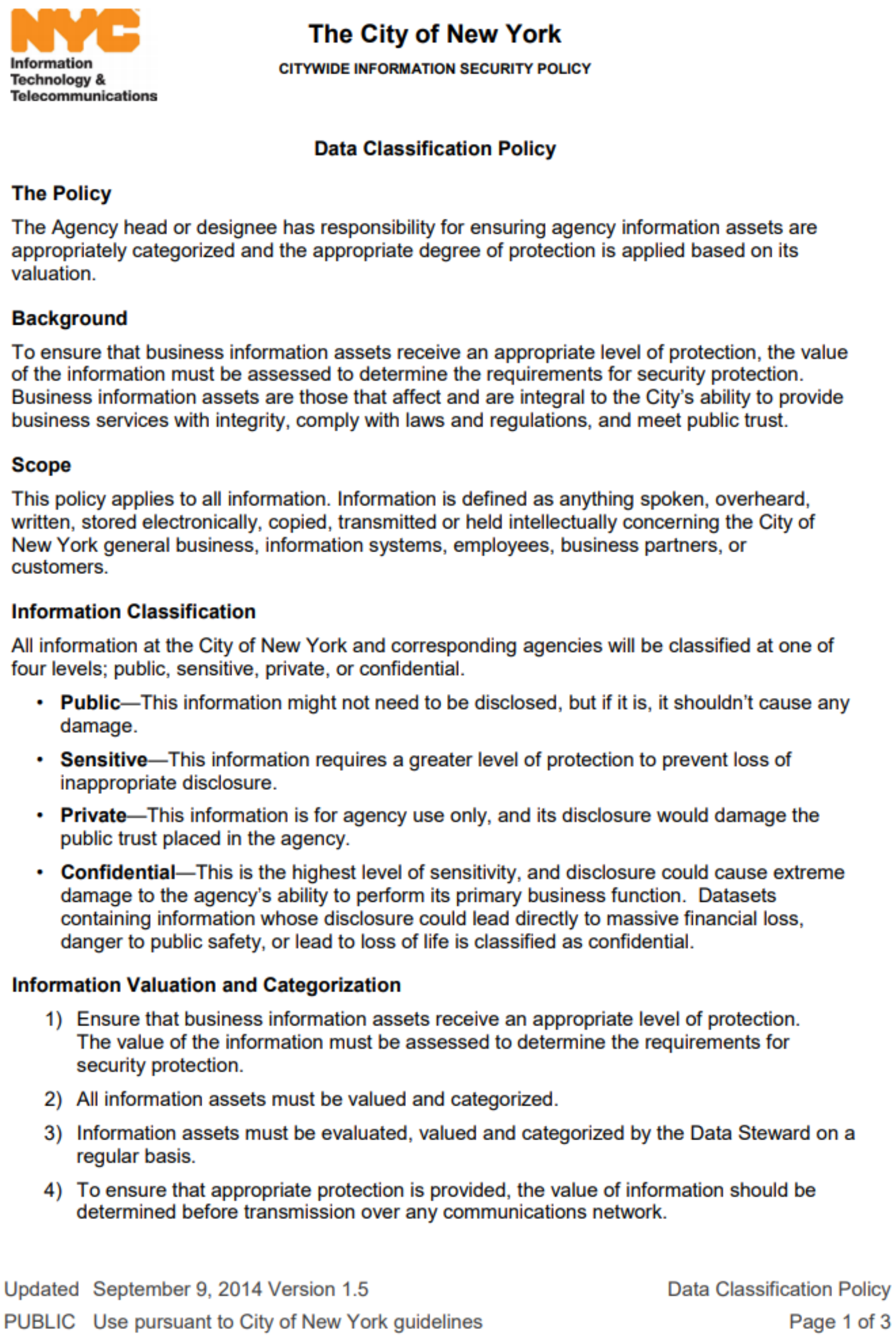
# Policy Example



Special Publication 800-53A
Revision 4

Assessing Security and Privacy Controls in Federal Information Systems
and Organizations — *Building Effective Assessment Plans*

| RA-2 | SECURITY CATEGORIZATION | |
|---|---|---|
| | **ASSESSMENT OBJECTIVE:**<br>*Determine if the organization:* | |
| | **RA-2(a)** | *categorizes information and the information system in accordance with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance;* |
| | **RA-2(b)** | *documents the security categorization results (including supporting rationale) in the security plan for the information system; and* |
| | **RA-2(c)** | *ensures the authorizing official or authorizing official designated representative reviews and approves the security categorization decision.* |
| | **POTENTIAL ASSESSMENT METHODS AND OBJECTS:**<br>**Examine**: [*SELECT FROM:* Risk assessment policy; security planning policy and procedures; procedures addressing security categorization of organizational information and information systems; security plan; security categorization documentation; other relevant documents or records].<br>**Interview**: [*SELECT FROM:* Organizational personnel with security categorization and risk assessment responsibilities; organizational personnel with information security responsibilities].<br>**Test**: [*SELECT FROM:* Organizational processes for security categorization]. | |



NYC Information Technology & Telecommunications

**The City of New York**
**CITYWIDE INFORMATION SECURITY POLICY**

**Data Classification Policy**

**The Policy**

The Agency head or designee has responsibility for ensuring agency information assets are appropriately categorized and the appropriate degree of protection is applied based on its valuation.

**Background**

To ensure that business information assets receive an appropriate level of protection, the value of the information must be assessed to determine the requirements for security protection. Business information assets are those that affect and are integral to the City's ability to provide business services with integrity, comply with laws and regulations, and meet public trust.

**Scope**

This policy applies to all information. Information is defined as anything spoken, overheard, written, stored electronically, copied, transmitted or held intellectually concerning the City of New York general business, information systems, employees, business partners, or customers.

**Information Classification**

All information at the City of New York and corresponding agencies will be classified at one of four levels; public, sensitive, private, or confidential.

- **Public**—This information might not need to be disclosed, but if it is, it shouldn't cause any damage.
- **Sensitive**—This information requires a greater level of protection to prevent loss of inappropriate disclosure.
- **Private**—This information is for agency use only, and its disclosure would damage the public trust placed in the agency.
- **Confidential**—This is the highest level of sensitivity, and disclosure could cause extreme damage to the agency's ability to perform its primary business function. Datasets containing information whose disclosure could lead directly to massive financial loss, danger to public safety, or lead to loss of life is classified as confidential.

**Information Valuation and Categorization**

1) Ensure that business information assets receive an appropriate level of protection. The value of the information must be assessed to determine the requirements for security protection.
2) All information assets must be valued and categorized.
3) Information assets must be evaluated, valued and categorized by the Data Steward on a regular basis.
4) To ensure that appropriate protection is provided, the value of information should be determined before transmission over any communications network.

Updated September 9, 2014 Version 1.5 — Data Classification Policy
PUBLIC Use pursuant to City of New York guidelines — Page 1 of 3

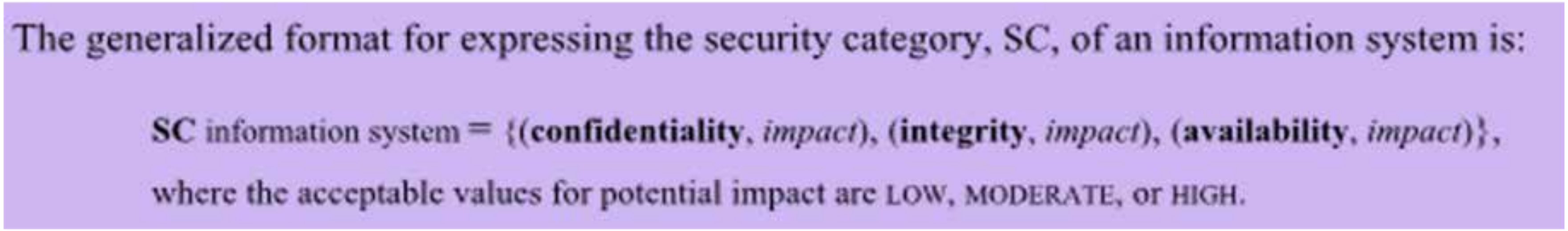
# There are alternative “code word” classification systems for data

| Clearance | | |
|---|---|---|
| Highest | Top secret | Unauthorized disclosure could be expected to cause “exceptionally grave damage” to national security |
| 2nd highest | Secret | Unauthorized disclosure would cause “serious damage” to national security |
| Lowest | Confidential | Unauthorized disclosure would “damage” national security |
| *Unclassified* | *Sensitive But Classified* | *Synonym* |
| *Unclassified* | *For Official Use Only (FOUO)* | *Synonym* |
| *Unclassified* | *Controlled Unclassified Information (CUI)* | *Synonym* |
| Unclassified | … | … |

- *The need to protect information is different in different sorts of organizations*
- *A principal distinction exists between government and business*
- *But, the terms used for CUI overlap in scope and are often intermingled often resulting in confusion*

# *Which do you prefer?*

FIPS 199 Standard



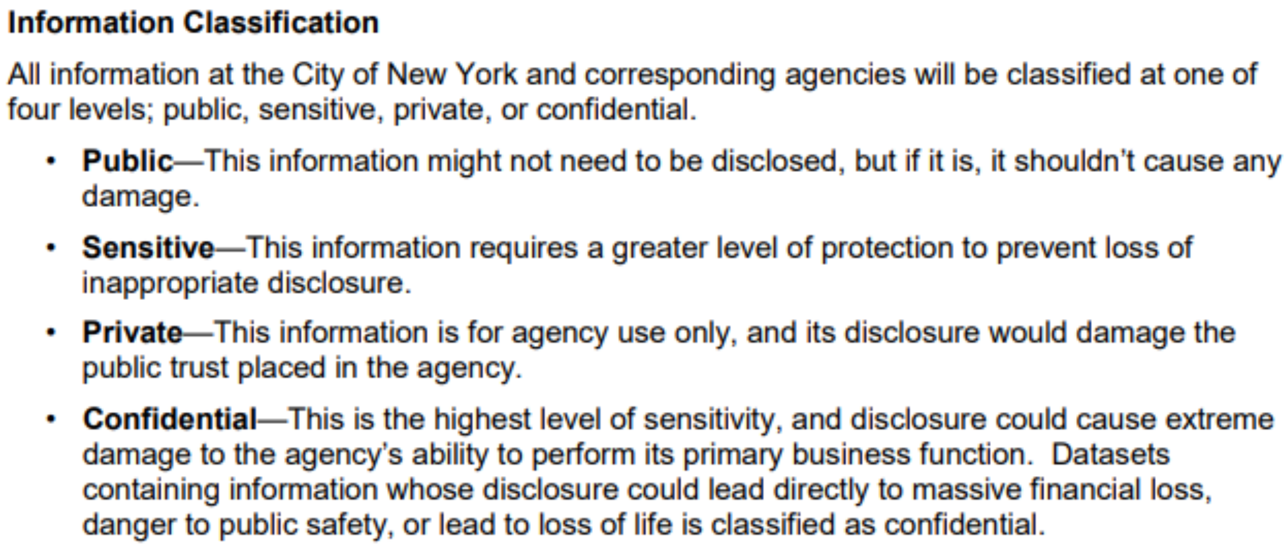
The generalized format for expressing the security category, SC, of an information system is:

SC information system = {(**confidentiality**, *impact*), (**integrity**, *impact*), (**availability**, *impact*)},

where the acceptable values for potential impact are LOW, MODERATE, or HIGH.

*…or…*

New York City Data Classification Policy



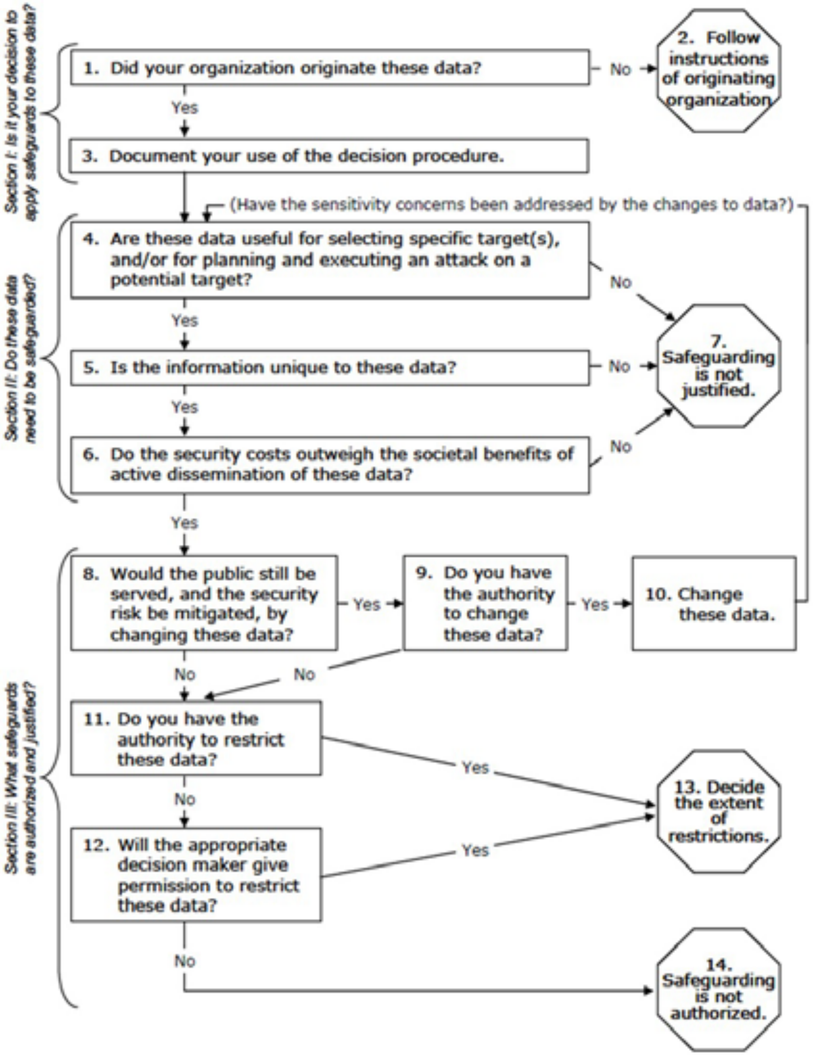
**Information Classification**

All information at the City of New York and corresponding agencies will be classified at one of four levels; public, sensitive, private, or confidential.

- **Public**—This information might not need to be disclosed, but if it is, it shouldn't cause any damage.
- **Sensitive**—This information requires a greater level of protection to prevent loss of inappropriate disclosure.
- **Private**—This information is for agency use only, and its disclosure would damage the public trust placed in the agency.
- **Confidential**—This is the highest level of sensitivity, and disclosure could cause extreme damage to the agency's ability to perform its primary business function. Datasets containing information whose disclosure could lead directly to massive financial loss, danger to public safety, or lead to loss of life is classified as confidential.

***Why?***

# Analyzing datasets based on the need for confidentiality



Section I: Is it your decision to apply safeguards to these data?

1. Did your organization originate these data?

No → 2. Follow instructions of originating organization

Yes → 3. Document your use of the decision procedure.

(Have the sensitivity concerns been addressed by the changes to data?)

Section II: Do these data need to be safeguarded?

4. Are these data useful for selecting specific target(s), and/or for planning and executing an attack on a potential target?

No → 7. Safeguarding is not justified.

Yes → 5. Is the information unique to these data?

No → 7. Safeguarding is not justified.

Yes → 6. Do the security costs outweigh the societal benefits of active dissemination of these data?

No → 7. Safeguarding is not justified.

Yes

Section III: What safeguards are authorized and justified?

8. Would the public still be served, and the security risk be mitigated, by changing these data?

Yes → 9. Do you have the authority to change these data?

Yes → 10. Change these data.

No

No

11. Do you have the authority to restrict these data?

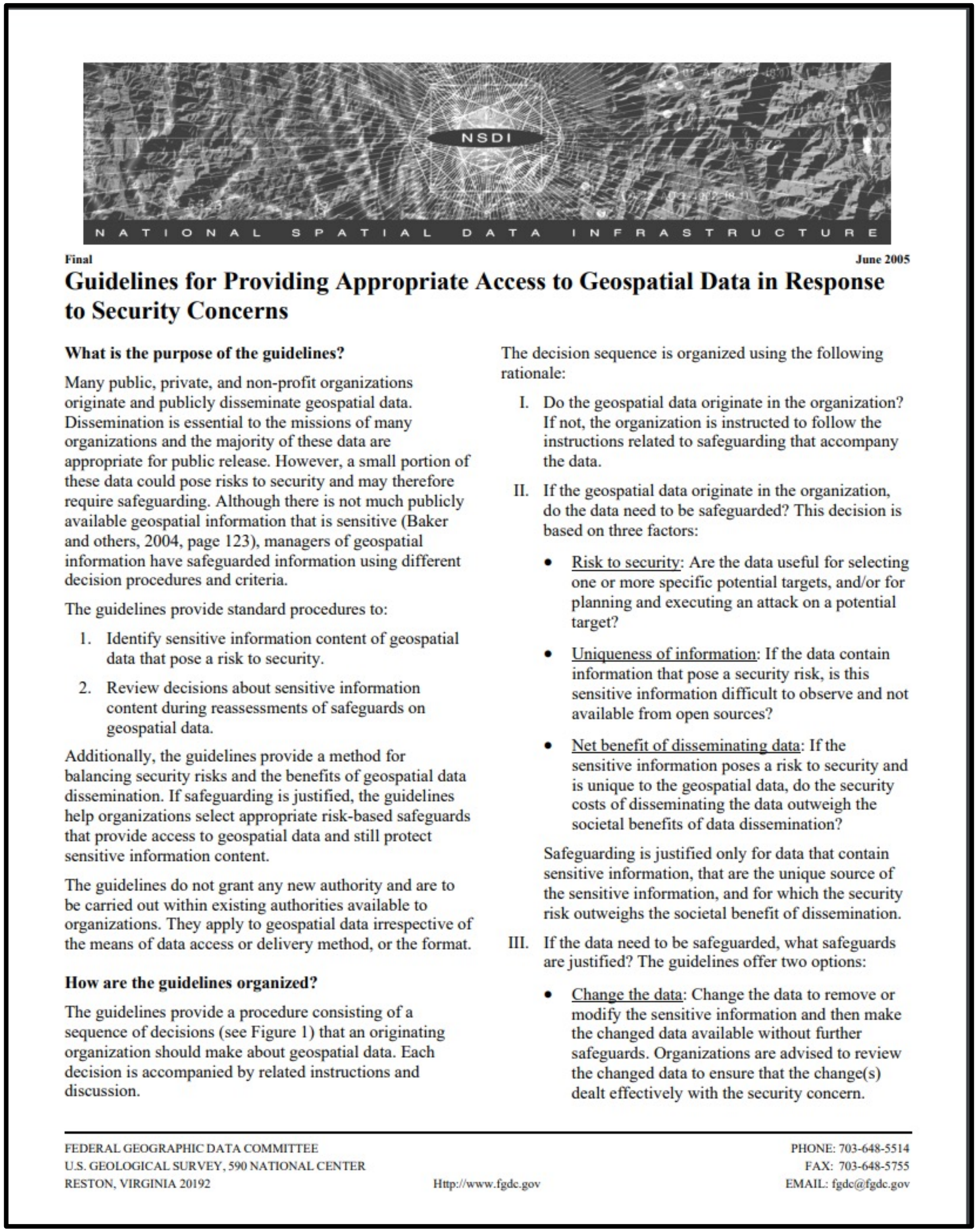
Yes → 13. Decide the extent of restrictions.

No

12. Will the appropriate decision maker give permission to restrict these data?

Yes → 13. Decide the extent of restrictions.

No → 14. Safeguarding is not authorized.



NSDI
NATIONAL SPATIAL DATA INFRASTRUCTURE

Final June 2005

## Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns

### What is the purpose of the guidelines?

Many public, private, and non-profit organizations originate and publicly disseminate geospatial data. Dissemination is essential to the missions of many organizations and the majority of these data are appropriate for public release. However, a small portion of these data could pose risks to security and may therefore require safeguarding. Although there is not much publicly available geospatial information that is sensitive (Baker and others, 2004, page 123), managers of geospatial information have safeguarded information using different decision procedures and criteria.

The guidelines provide standard procedures to:

1. Identify sensitive information content of geospatial data that pose a risk to security.
2. Review decisions about sensitive information content during reassessments of safeguards on geospatial data.

Additionally, the guidelines provide a method for balancing security risks and the benefits of geospatial data dissemination. If safeguarding is justified, the guidelines help organizations select appropriate risk-based safeguards that provide access to geospatial data and still protect sensitive information content.

The guidelines do not grant any new authority and are to be carried out within existing authorities available to organizations. They apply to geospatial data irrespective of the means of data access or delivery method, or the format.

### How are the guidelines organized?

The guidelines provide a procedure consisting of a sequence of decisions (see Figure 1) that an originating organization should make about geospatial data. Each decision is accompanied by related instructions and discussion.

The decision sequence is organized using the following rationale:

I. Do the geospatial data originate in the organization? If not, the organization is instructed to follow the instructions related to safeguarding that accompany the data.

II. If the geospatial data originate in the organization, do the data need to be safeguarded? This decision is based on three factors:

- Risk to security: Are the data useful for selecting one or more specific potential targets, and/or for planning and executing an attack on a potential target?
- Uniqueness of information: If the data contain information that pose a security risk, is this sensitive information difficult to observe and not available from open sources?
- Net benefit of disseminating data: If the sensitive information poses a risk to security and is unique to the geospatial data, do the security costs of disseminating the data outweigh the societal benefits of data dissemination?

Safeguarding is justified only for data that contain sensitive information, that are the unique source of the sensitive information, and for which the security risk outweighs the societal benefit of dissemination.

III. If the data need to be safeguarded, what safeguards are justified? The guidelines offer two options:

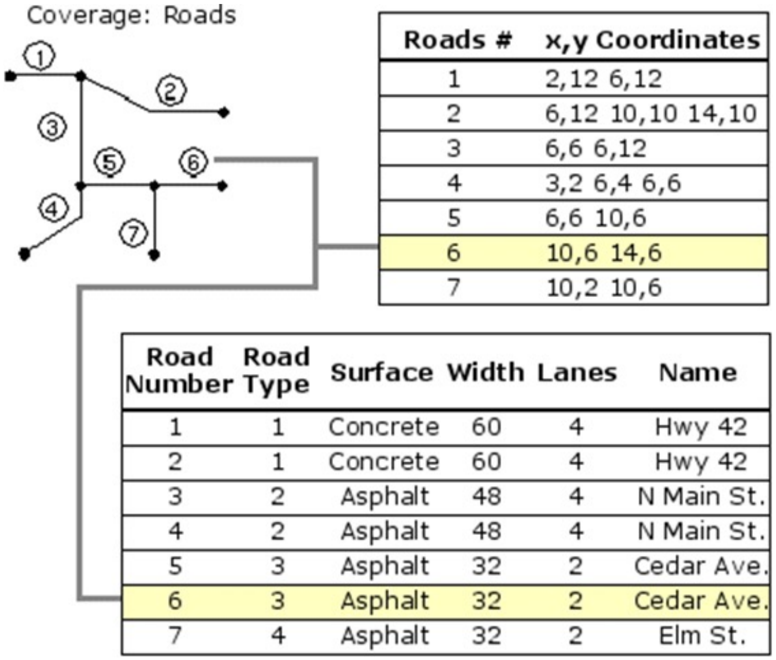
- Change the data: Change the data to remove or modify the sensitive information and then make the changed data available without further safeguards. Organizations are advised to review the changed data to ensure that the change(s) dealt effectively with the security concern.

FEDERAL GEOGRAPHIC DATA COMMITTEE
U.S. GEOLOGICAL SURVEY, 590 NATIONAL CENTER
RESTON, VIRGINIA 20192

Http://www.fgdc.gov

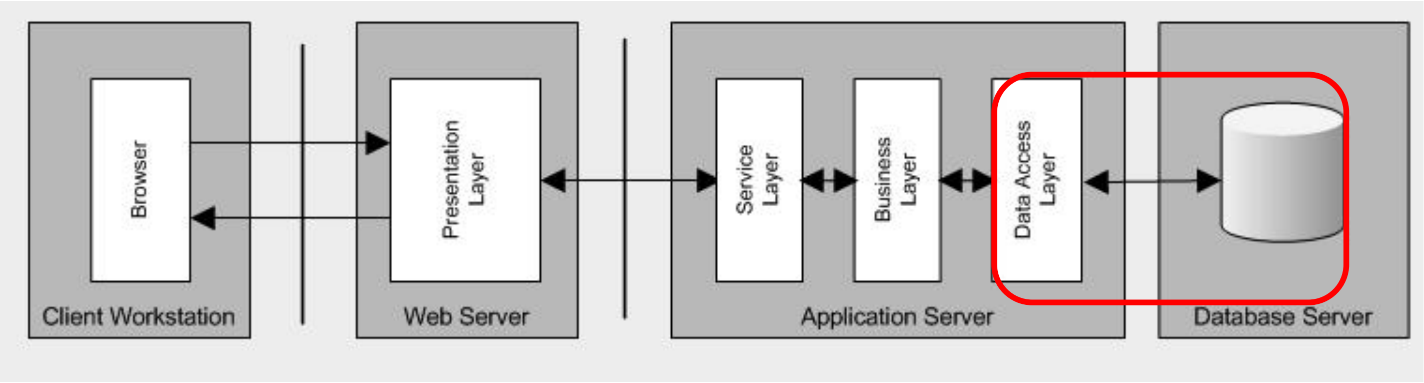
PHONE: 703-648-5514
FAX: 703-648-5755
EMAIL: fgdc@fgdc.gov

# Geo-Relational datasets

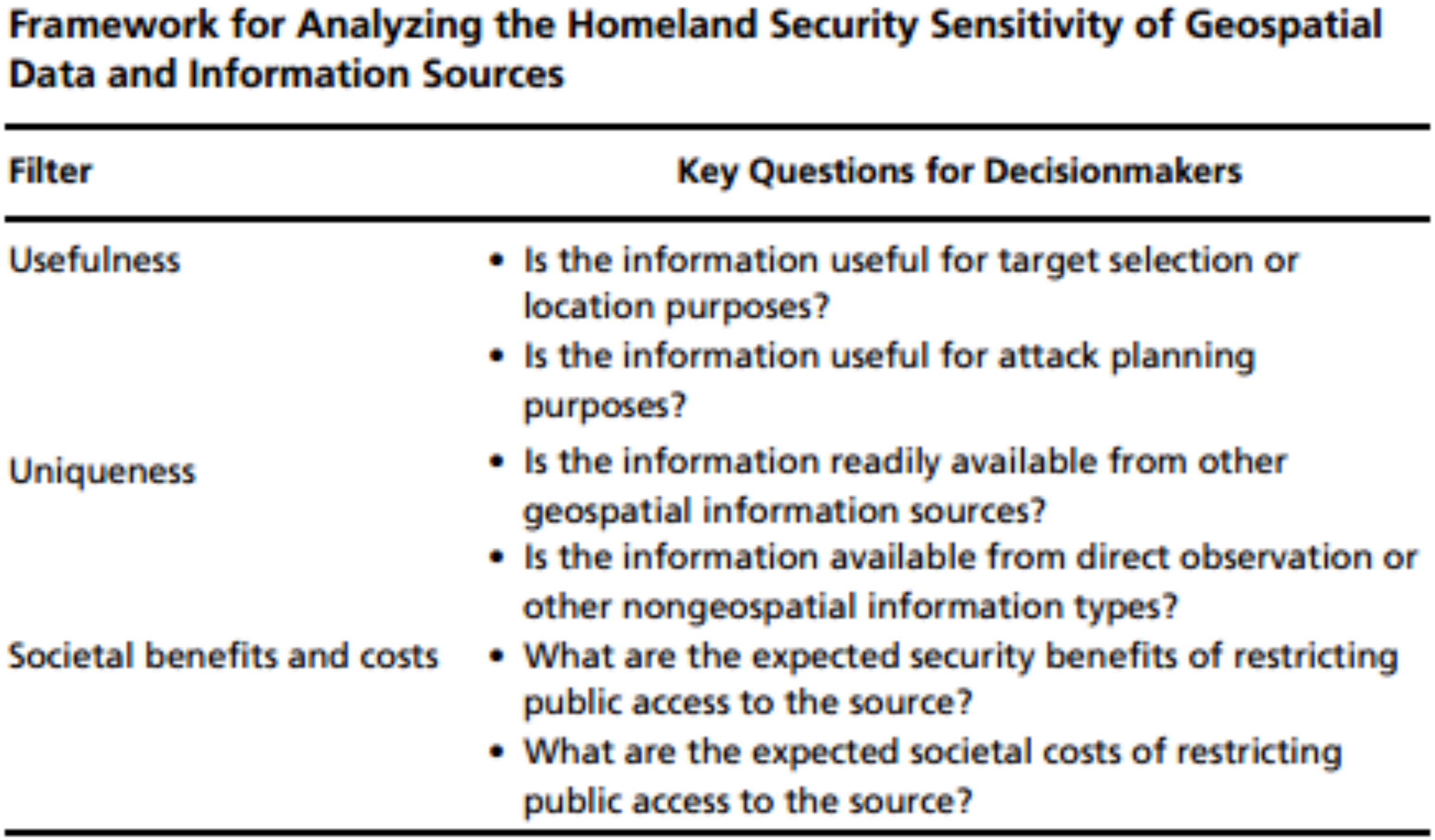


| Roads # | x,y Coordinates |
|---|---|
| 1 | 2,12 6,12 |
| 2 | 6,12 10,10 14,10 |
| 3 | 6,6 6,12 |
| 4 | 3,2 6,4 6,6 |
| 5 | 6,6 10,6 |
| 6 | 10,6 14,6 |
| 7 | 10,2 10,6 |

| Road Number | Road Type | Surface | Width | Lanes | Name |
|---|---|---|---|---|---|
| 1 | 1 | Concrete | 60 | 4 | Hwy 42 |
| 2 | 1 | Concrete | 60 | 4 | Hwy 42 |
| 3 | 2 | Asphalt | 48 | 4 | N Main St. |
| 4 | 2 | Asphalt | 48 | 4 | N Main St. |
| 5 | 3 | Asphalt | 32 | 2 | Cedar Ave. |
| 6 | 3 | Asphalt | 32 | 2 | Cedar Ave. |
| 7 | 4 | Asphalt | 32 | 2 | Elm St. |

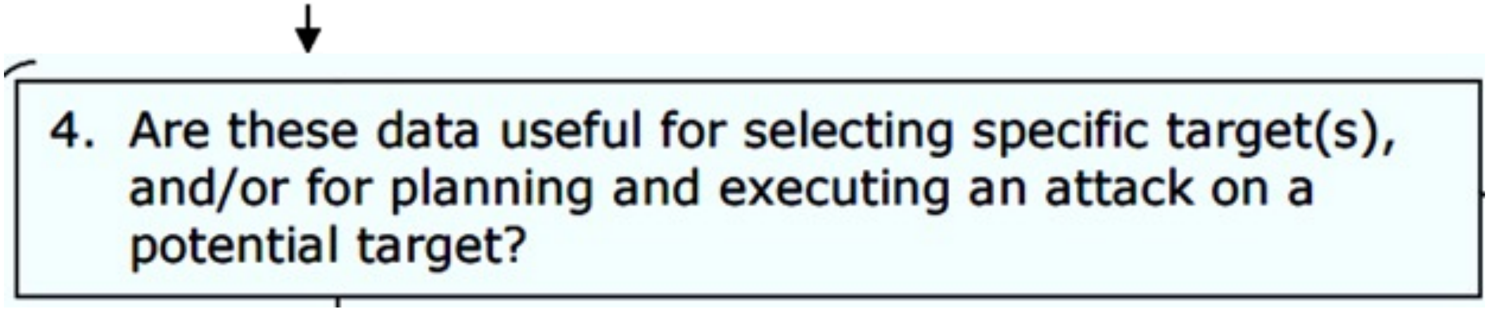


# Confidentiality categorization example…



**Framework for Analyzing the Homeland Security Sensitivity of Geospatial Data and Information Sources**

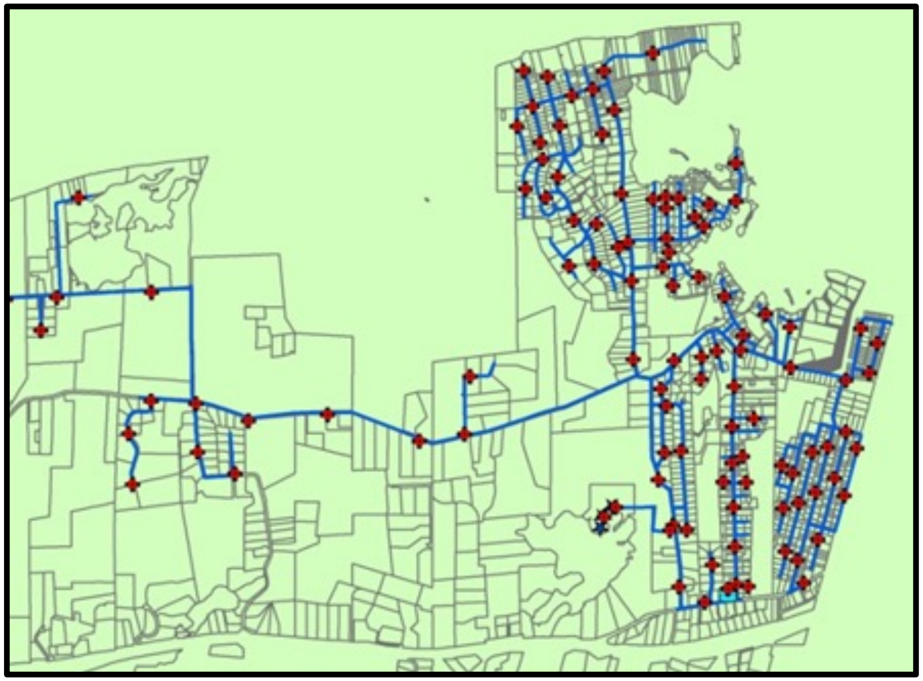
| Filter | Key Questions for Decisionmakers |
|---|---|
| Usefulness | • Is the information useful for target selection or location purposes?<br>• Is the information useful for attack planning purposes? |
| Uniqueness | • Is the information readily available from other geospatial information sources?<br>• Is the information available from direct observation or other nongeospatial information types? |
| Societal benefits and costs | • What are the expected security benefits of restricting public access to the source?<br>• What are the expected societal costs of restricting public access to the source? |



4. Are these data useful for selecting specific target(s), and/or for planning and executing an attack on a potential target?

*Do the data show choke points” to increase effectiveness of an attack ?*

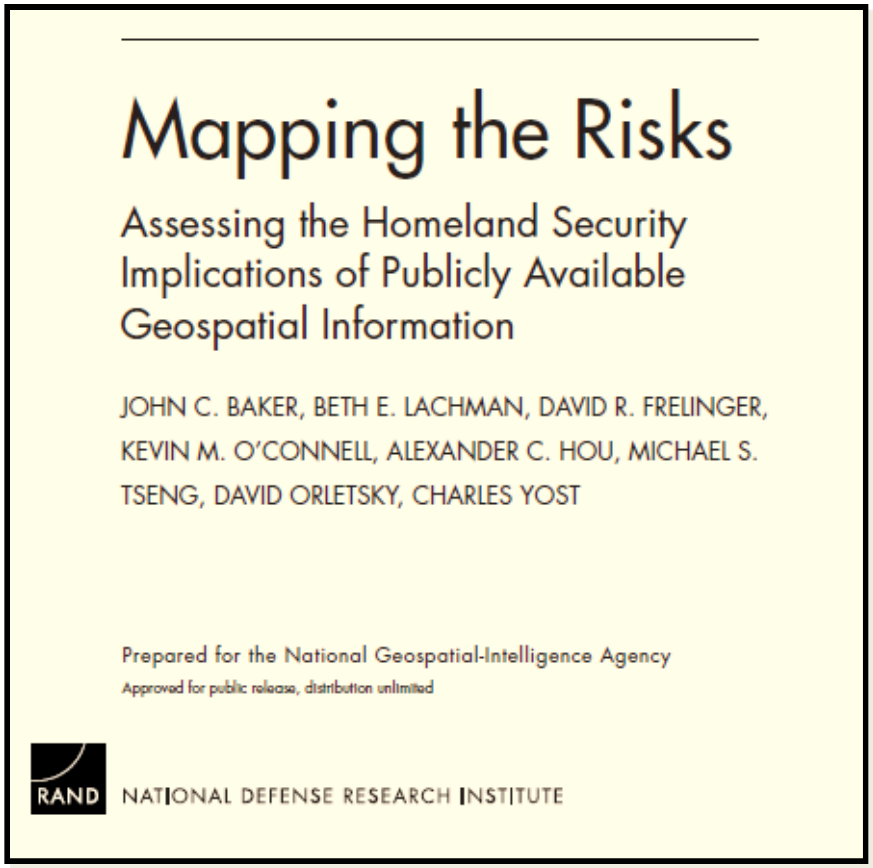
*Do the data show opportunities for competitors to gain an advantage?*



# Audit of public geospatial information

RAND’s 2004 deliverable included an audit of

- 465 programs/offices/initiatives at 30 agencies and departments identified as providing geospatial information to the public
  - 628 public datasets sampled from websites
  - 37 (~6%) found to be useful in helping an attacker select a target or plan an attack against a site
    - None were considered so critical that an “attacker could not perform the attack without” them
- Conclusions
  - Publically available geospatial “information needed for identifying and locating potential targets is widely accessible”
  - “…detailed and up-to-date information required for attack planning against a particular target is much less readily available”



Mapping the Risks

Assessing the Homeland Security Implications of Publicly Available Geospatial Information

JOHN C. BAKER, BETH E. LACHMAN, DAVID R. FRELINGER, KEVIN M. O’CONNELL, ALEXANDER C. HOU, MICHAEL S. TSENG, DAVID ORLETSKY, CHARLES YOST

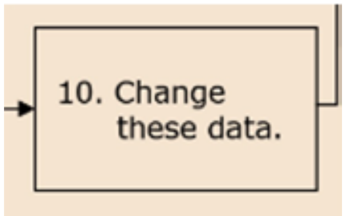
Prepared for the National Geospatial-Intelligence Agency

Approved for public release, distribution unlimited

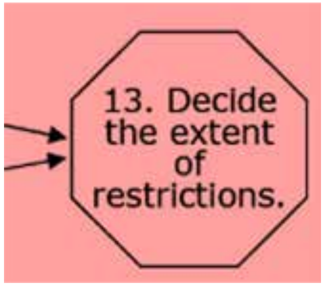
RAND NATIONAL DEFENSE RESEARCH INSTITUTE

# If security risks outweigh benefits of releasing the data to the public, agency can choose to safeguard data by:

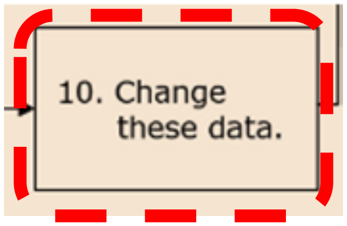
- **Modifying data**
  - Remove or reduce detail in offending data elements
    - either in the attributes, spatial representations, or both



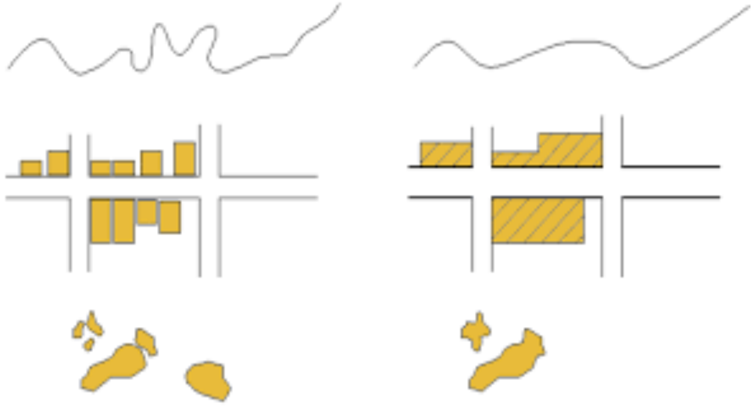
- **Restricting access to data**
  - If agency lacks authority to change data, or believes modifying data will undermine its value to the public, then agency can restrict access



# …control/mitigate risk…



10. Change these data.

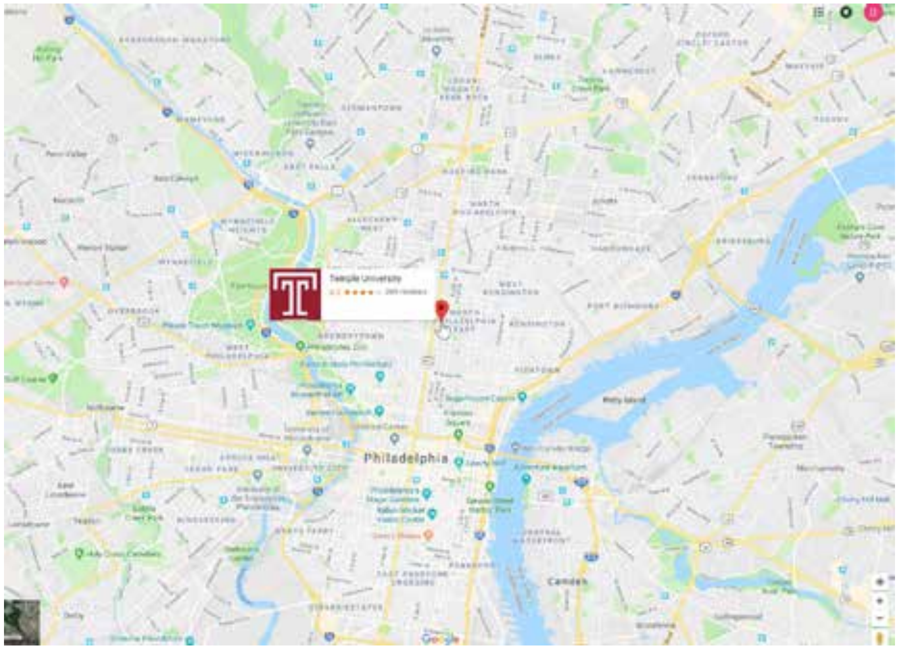


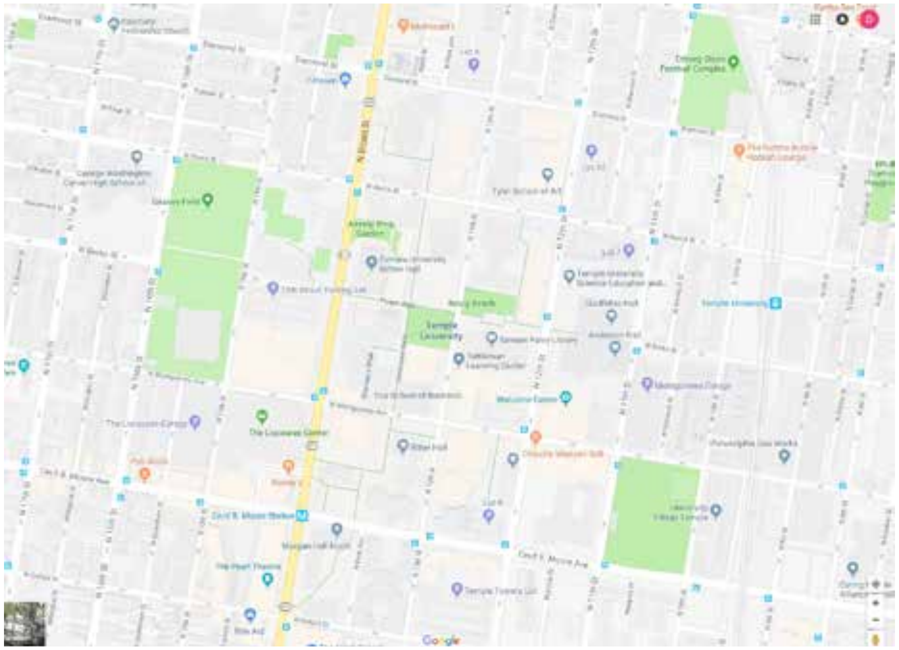
*Before …*

*…after*

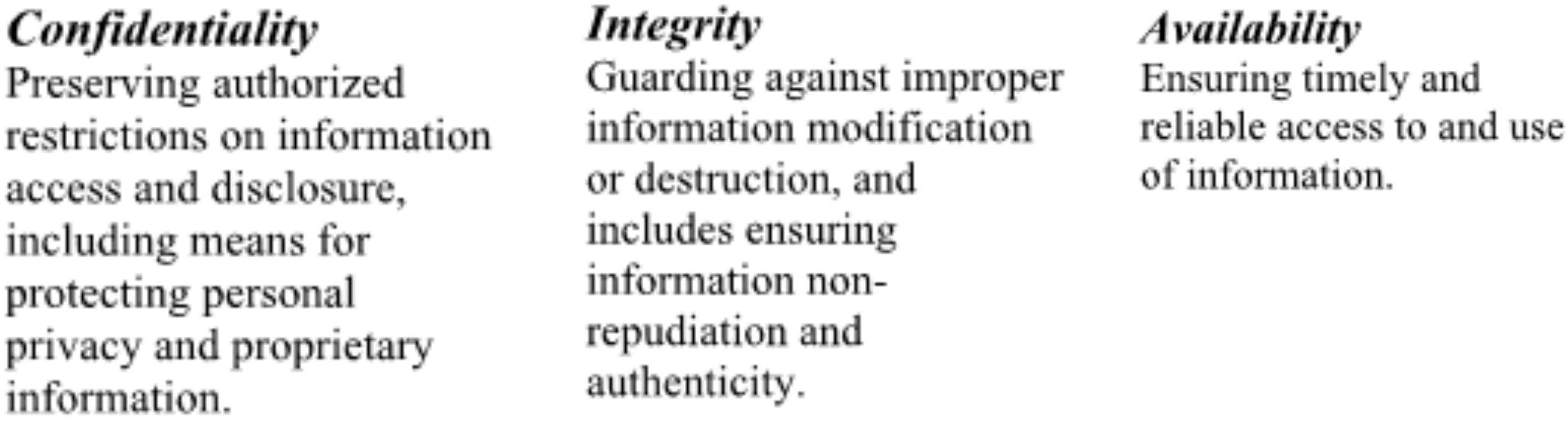
To remove or reduce detail in offending data elements apply techniques of ***Cartographic Generalization***

1. *Selective Omission*
2. *Simplification*
3. *Combination*





# What is the security objective of FGDC’s Guidelines ?



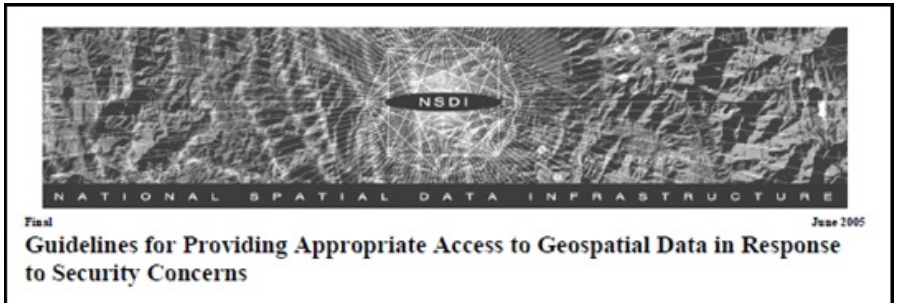
***Confidentiality***
Preserving authorized restrictions on information access and disclosure, including means for protecting personal privacy and proprietary information.

***Integrity***
Guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity.

***Availability***
Ensuring timely and reliable access to and use of information.

? ? ?

# What FIPS 199 security objectives are at risk by implementing the FGDC’s Guidelines ?



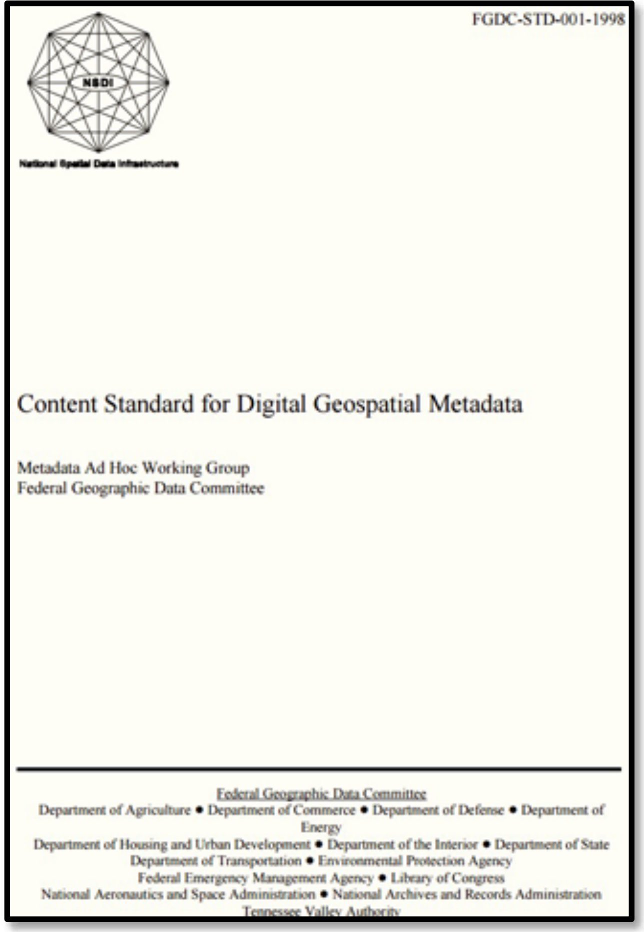
Final

June 2005

Guidelines for Providing Appropriate Access to Geospatial Data in Response to Security Concerns

# Metadata enables communicating data classification information

2 examples of metadata standards that include security categorization information for geographic datasets



FGDC-STD-001-1998

NSDI

National Spatial Data Infrastructure

Content Standard for Digital Geospatial Metadata

Metadata Ad Hoc Working Group
Federal Geographic Data Committee

Federal Geographic Data Committee
Department of Agriculture • Department of Commerce • Department of Defense • Department of Energy
Department of Housing and Urban Development • Department of the Interior • Department of State
Department of Transportation • Environmental Protection Agency
Federal Emergency Management Agency • Library of Congress
National Aeronautics and Space Administration • National Archives and Records Administration
Tennessee Valley Authority

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 19115-1

April 2014

ICS 35.240.70

Supersedes EN ISO 19115:2005

English Version

Geographic information —
Metadata —
Part 1: Fundamentals
(ISO 19115-1:2014)

Information géographique —
Métadonnées —
Partie 1: Principes de base
(ISO 19115-1:2014)

Geoinformation —
Metadaten —
Teil 1: Grundsätze
(ISO 19115-1:2014)

This European Standard was approved by CEN on 22 February 2014.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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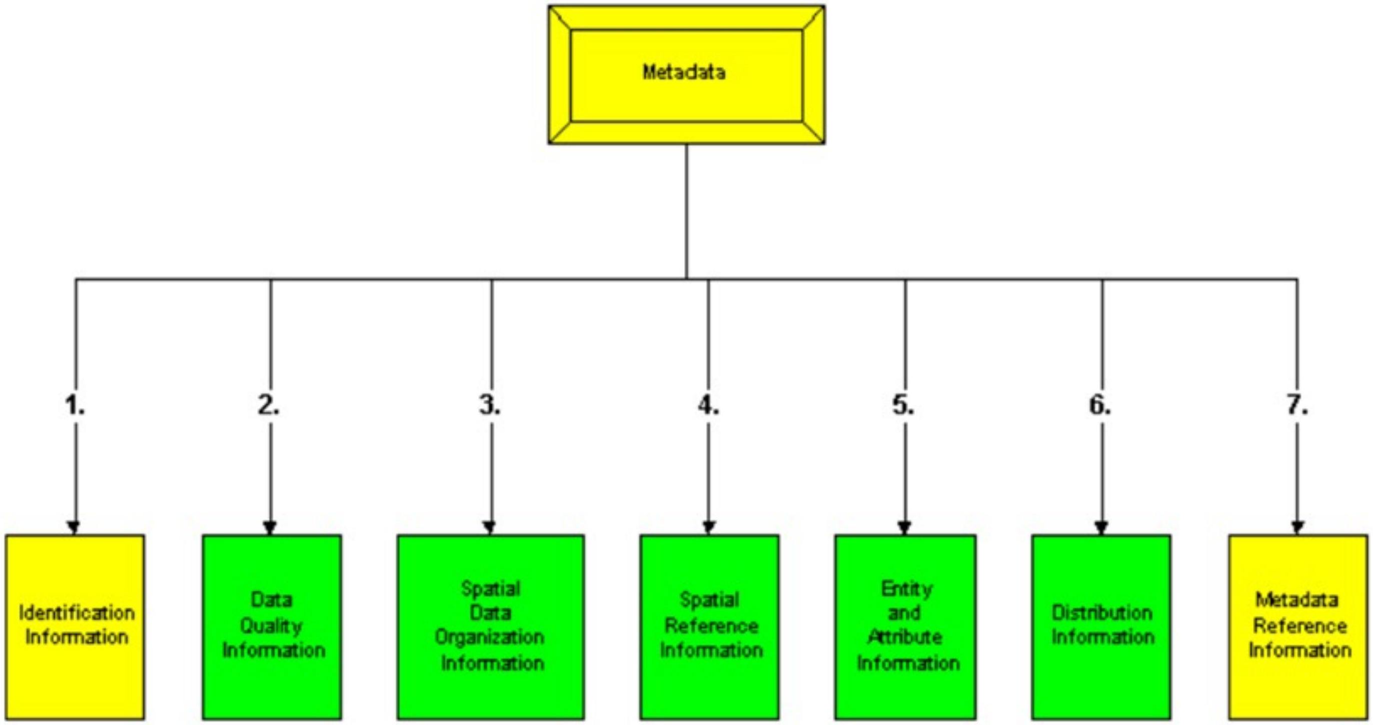
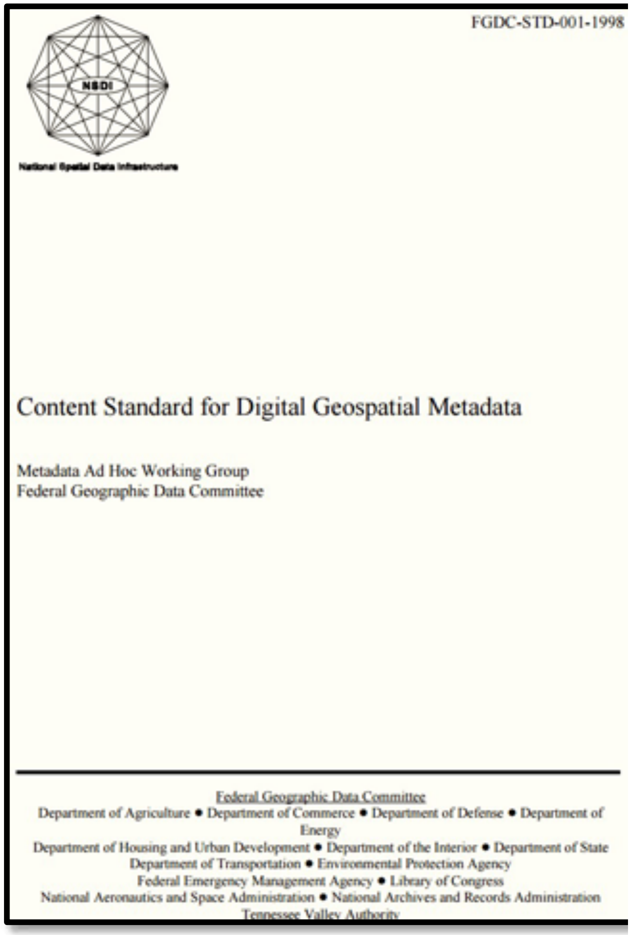
Ref. No. EN ISO 19115-1:2014 E


Metadata
1.
2.
3.
4.
5.
6.
7.
Identification Information
Data Quality Information
Spatial Data Organization Information
Spatial Reference Information
Entity and Attribute Information
Distribution Information
Metadata Reference Information


FGDC-STD-001-1998

Content Standard for Digital Geospatial Metadata

Metadata Ad Hoc Working Group
Federal Geographic Data Committee

Federal Geographic Data Committee
Department of Agriculture • Department of Commerce • Department of Defense • Department of Energy
Department of Housing and Urban Development • Department of the Interior • Department of State
Department of Transportation • Environmental Protection Agency
Federal Emergency Management Agency • Library of Congress
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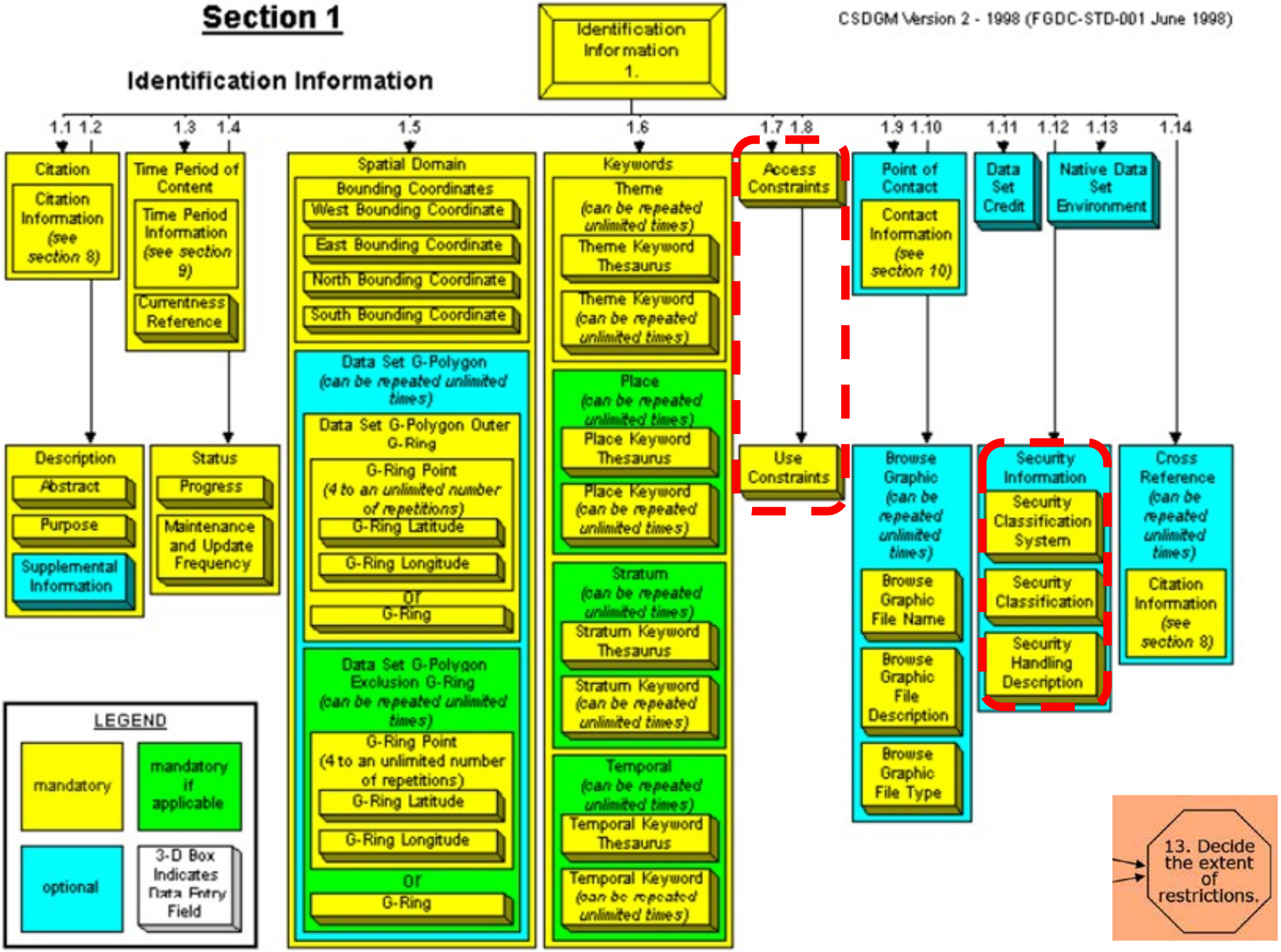
Tennessee Valley Authority

# Section 1

## Identification Information

CSDGM Version 2 - 1998 (FGDC-STD-001 June 1998)



Identification Information 1.

1.1 Citation
- Citation Information (see section 8)

1.2 Description
- Abstract
- Purpose
- Supplemental Information

1.3 Time Period of Content
- Time Period Information (see section 9)
- Currentness Reference

1.4 Status
- Progress
- Maintenance and Update Frequency

1.5 Spatial Domain
- Bounding Coordinates
  - West Bounding Coordinate
  - East Bounding Coordinate
  - North Bounding Coordinate
  - South Bounding Coordinate
- Data Set G-Polygon (can be repeated unlimited times)
  - Data Set G-Polygon Outer G-Ring
    - G-Ring Point (4 to an unlimited number of repetitions)
      - G-Ring Latitude
      - G-Ring Longitude
    - Or
    - G-Ring
  - Data Set G-Polygon Exclusion G-Ring (can be repeated unlimited times)
    - G-Ring Point (4 to an unlimited number of repetitions)
      - G-Ring Latitude
      - G-Ring Longitude
    - Or
    - G-Ring

1.6 Keywords
- Theme (can be repeated unlimited times)
  - Theme Keyword Thesaurus
  - Theme Keyword (can be repeated unlimited times)
- Place (can be repeated unlimited times)
  - Place Keyword Thesaurus
  - Place Keyword (can be repeated unlimited times)
- Stratum (can be repeated unlimited times)
  - Stratum Keyword Thesaurus
  - Stratum Keyword (can be repeated unlimited times)
- Temporal (can be repeated unlimited times)
  - Temporal Keyword Thesaurus
  - Temporal Keyword (can be repeated unlimited times)

1.7 Access Constraints

1.8 Use Constraints

1.9 Point of Contact
- Contact Information (see section 10)

1.10 Browse Graphic (can be repeated unlimited times)
- Browse Graphic File Name
- Browse Graphic File Description
- Browse Graphic File Type

1.11 Data Set Credit

1.12 Security Information
- Security Classification System
- Security Classification
- Security Handling Description

1.13 Native Data Set Environment

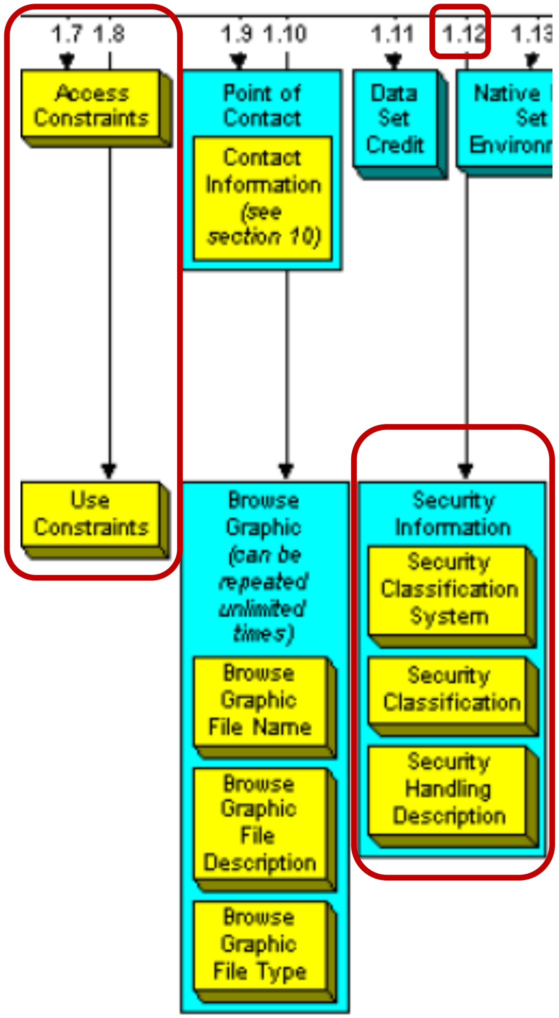
1.14 Cross Reference (can be repeated unlimited times)
- Citation Information (see section 8)

LEGEND

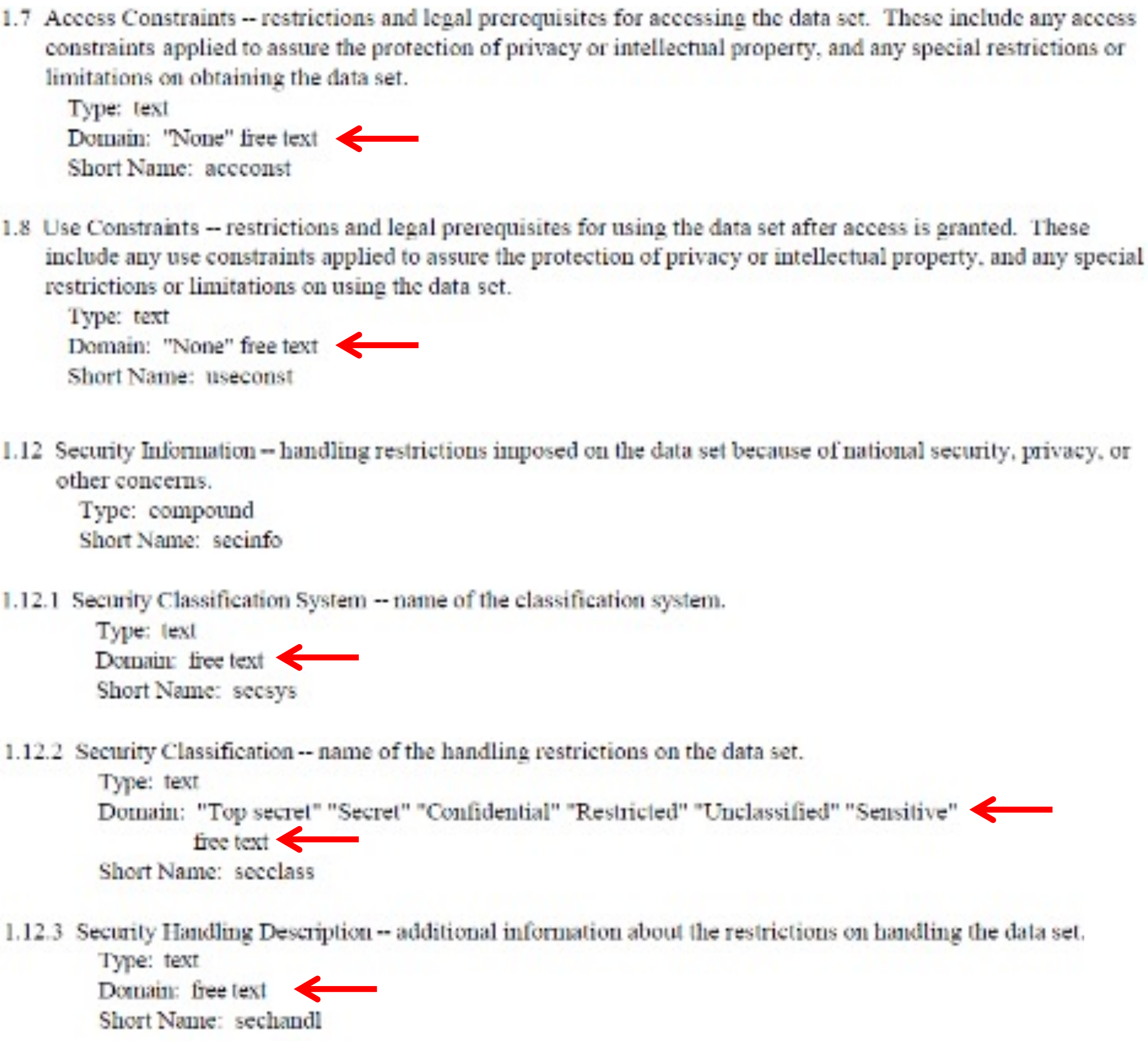
| | |
|---|---|
| 🟨 mandatory | 🟩 mandatory if applicable |
| 🟦 optional | 3-D Box Indicates Data Entry Field |

13. Decide the extent of restrictions.

# Communicating risk classification and controls…



**Note: Be wary of *metadata with undefined or free text domains***



1.7 Access Constraints -- restrictions and legal prerequisites for accessing the data set. These include any access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the data set.
Type: text
Domain: "None" free text
Short Name: accconst

1.8 Use Constraints -- restrictions and legal prerequisites for using the data set after access is granted. These include any use constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the data set.
Type: text
Domain: "None" free text
Short Name: useconst

1.12 Security Information -- handling restrictions imposed on the data set because of national security, privacy, or other concerns.
Type: compound
Short Name: secinfo

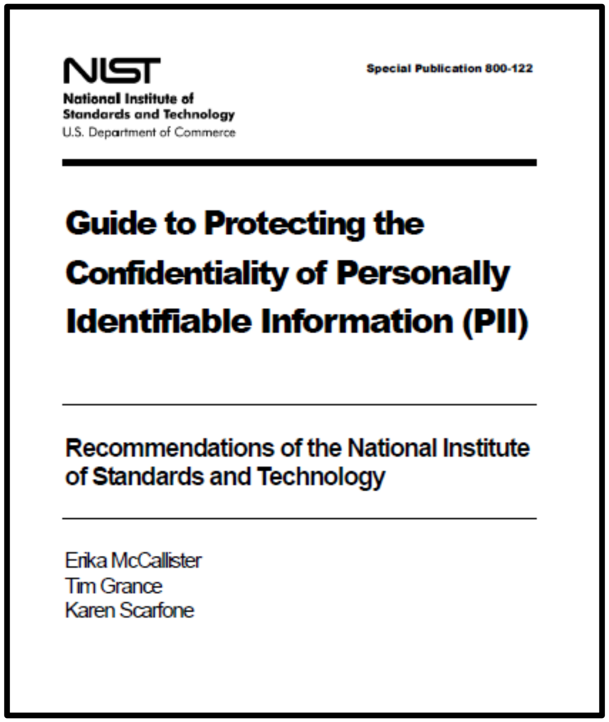
1.12.1 Security Classification System -- name of the classification system.
Type: text
Domain: free text
Short Name: secsys

1.12.2 Security Classification -- name of the handling restrictions on the data set.
Type: text
Domain: "Top secret" "Secret" "Confidential" "Restricted" "Unclassified" "Sensitive"
free text
Short Name: secclass

1.12.3 Security Handling Description -- additional information about the restrictions on handling the data set.
Type: text
Domain: free text
Short Name: sechandl

# NIST SP 800-122 – Guide to Protecting Confidentiality of PII

- Specifically focused on:
  - Identifying PII
  - **Determining PII confidentiality** impact level needed to supplement the FIPS 199 confidentiality impact level of an information system



NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Special Publication 800-122

**Guide to Protecting the Confidentiality of Personally Identifiable Information (PII)**

**Recommendations of the National Institute of Standards and Technology**

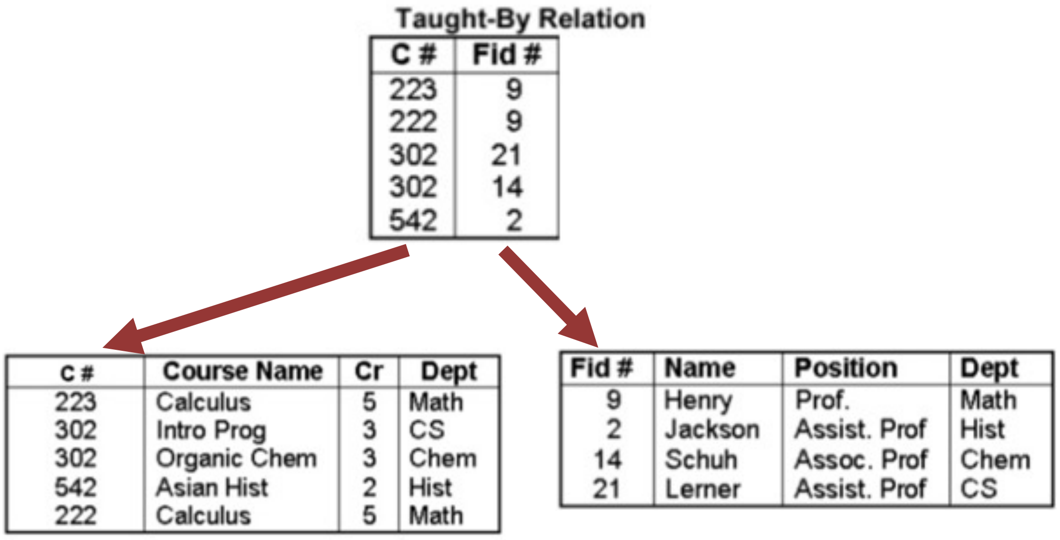
Erika McCallister
Tim Grance
Karen Scarfone

# Personally Identifiable Information (PII)

Any information about an individual maintained by an agency, including:

1. Any information that can be used to distinguish (i.e. identify) or trace an individual‘s identity, such as:
   - *Name*
   - *Identifying number*
   - *Address*
   - *Asset identifier*
   - *Telephone number*
   - *Personal characteristics*
   - *Personally owned property identifiers*
2. Any other information that is linked or linkable to the identifiers listed in #1:
   - Date of birth
   - Place of birth
   - Race
   - Religion
   - Weight
   - Geographic indicators
   - Medical information
   - Educational information
   - Financial information
   - Employment information
   - …

# Linked information



Taught-By Relation

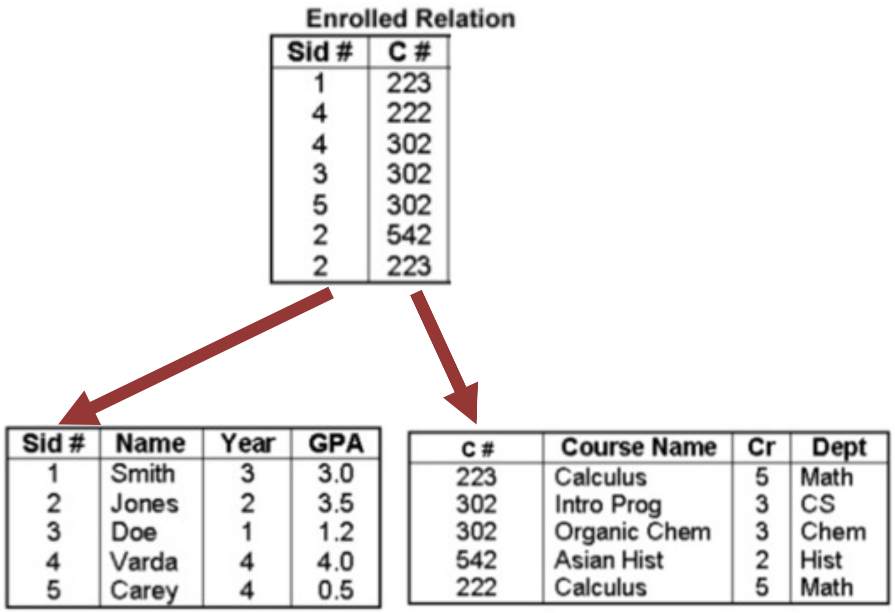
| C # | Fid # |
|---|---|
| 223 | 9 |
| 222 | 9 |
| 302 | 21 |
| 302 | 14 |
| 542 | 2 |

| C # | Course Name | Cr | Dept |
|---|---|---|---|
| 223 | Calculus | 5 | Math |
| 302 | Intro Prog | 3 | CS |
| 302 | Organic Chem | 3 | Chem |
| 542 | Asian Hist | 2 | Hist |
| 222 | Calculus | 5 | Math |

**Course Data Table**

| Fid # | Name | Position | Dept |
|---|---|---|---|
| 9 | Henry | Prof. | Math |
| 2 | Jackson | Assist. Prof | Hist |
| 14 | Schuh | Assoc. Prof | Chem |
| 21 | Lerner | Assist. Prof | CS |

**Faculty Data Table**



Enrolled Relation

| Sid # | C # |
|---|---|
| 1 | 223 |
| 4 | 222 |
| 4 | 302 |
| 3 | 302 |
| 5 | 302 |
| 2 | 542 |
| 2 | 223 |

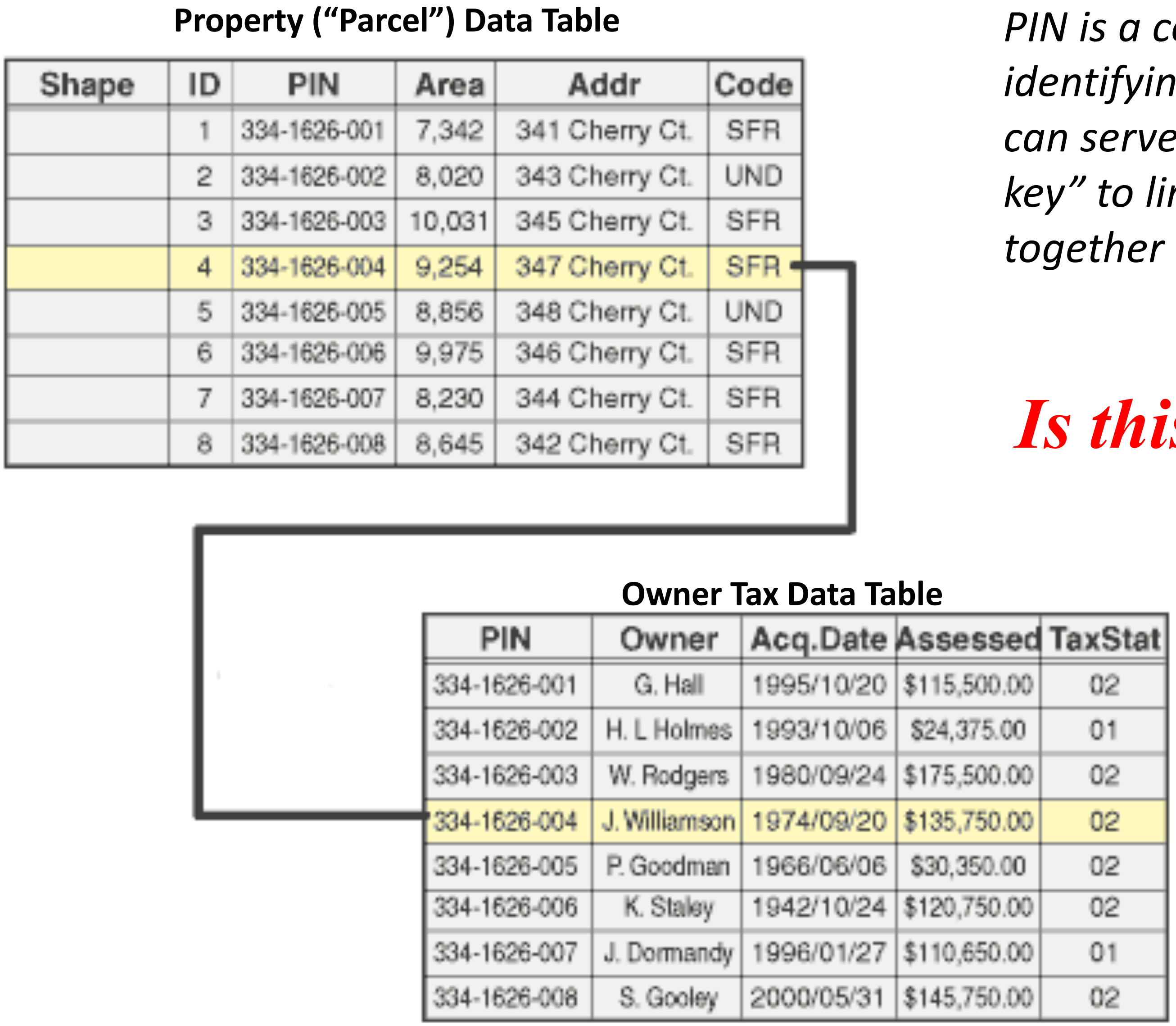
| Sid # | Name | Year | GPA |
|---|---|---|---|
| 1 | Smith | 3 | 3.0 |
| 2 | Jones | 2 | 3.5 |
| 3 | Doe | 1 | 1.2 |
| 4 | Varda | 4 | 4.0 |
| 5 | Carey | 4 | 0.5 |

**Student Data Table**

| C # | Course Name | Cr | Dept |
|---|---|---|---|
| 223 | Calculus | 5 | Math |
| 302 | Intro Prog | 3 | CS |
| 302 | Organic Chem | 3 | Chem |
| 542 | Asian Hist | 2 | Hist |
| 222 | Calculus | 5 | Math |

**Course Data Table**

# Linkable information



**Property ("Parcel") Data Table**

| Shape | ID | PIN | Area | Addr | Code |
|---|---|---|---|---|---|
| | 1 | 334-1626-001 | 7,342 | 341 Cherry Ct. | SFR |
| | 2 | 334-1626-002 | 8,020 | 343 Cherry Ct. | UND |
| | 3 | 334-1626-003 | 10,031 | 345 Cherry Ct. | SFR |
| | 4 | 334-1626-004 | 9,254 | 347 Cherry Ct. | SFR |
| | 5 | 334-1626-005 | 8,856 | 348 Cherry Ct. | UND |
| | 6 | 334-1626-006 | 9,975 | 346 Cherry Ct. | SFR |
| | 7 | 334-1626-007 | 8,230 | 344 Cherry Ct. | SFR |
| | 8 | 334-1626-008 | 8,645 | 342 Cherry Ct. | SFR |

**Owner Tax Data Table**

| PIN | Owner | Acq.Date | Assessed | TaxStat |
|---|---|---|---|---|
| 334-1626-001 | G. Hall | 1995/10/20 | $115,500.00 | 02 |
| 334-1626-002 | H. L Holmes | 1993/10/06 | $24,375.00 | 01 |
| 334-1626-003 | W. Rodgers | 1980/09/24 | $175,500.00 | 02 |
| 334-1626-004 | J. Williamson | 1974/09/20 | $135,750.00 | 02 |
| 334-1626-005 | P. Goodman | 1966/06/06 | $30,350.00 | 02 |
| 334-1626-006 | K. Staley | 1942/10/24 | $120,750.00 | 02 |
| 334-1626-007 | J. Dormandy | 1996/01/27 | $110,650.00 | 01 |
| 334-1626-008 | S. Gooley | 2000/05/31 | $145,750.00 | 02 |

*PIN is a common identifying number that can serve as a "foreign key" to link the data tables together*

**Is this PII ?**

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   - Religion
   - Weight
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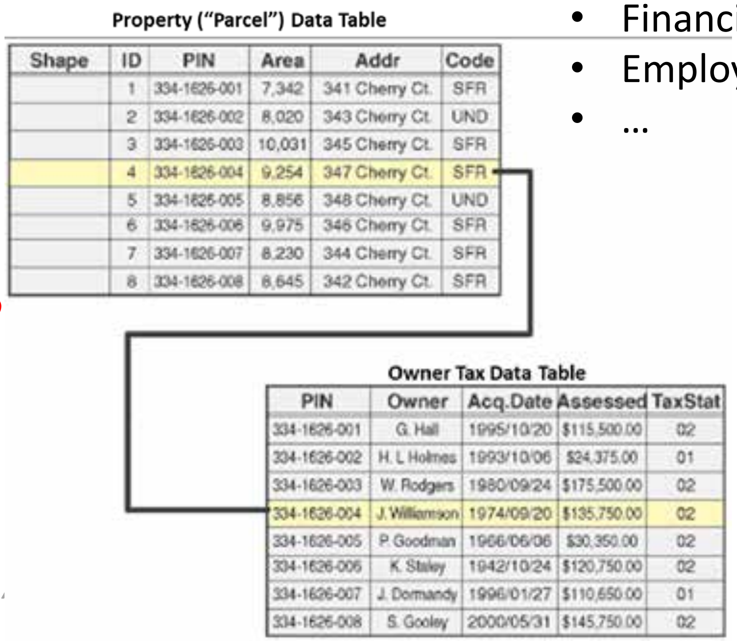
   - Medical information
   - Educational information
   - Financial information
   - Employment information
   - …



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| 334-1626-007 | J. Domandy | 1996/01/27 | $110,650.00 | 01 |
| 334-1626-008 | S. Gooley | 2000/05/31 | $145,750.00 | 02 |

***Is this PII ?***

# Test Taking Tip

*- Read the answers first -*

*This contradicts many people's test taking recommendations…*

…but, it works. Here's why:

- Quickly alerts you to the type of question to expect
- Focuses your attention in reading the question for meaningful information
- Gives you advanced warning that there may be more than one significant concepts (option to answer in the form "Both A & B")
- Gives you an opportunity to get a sense of the sort of answer the test maker is looking for
- There may be more than one valid answer, but the test maker may be looking for "best mitigation for the situation" or "least risk in the situation"

# Test Taking Tip

Example:

A. Transaction authorization
B. Loss or duplication of EDI transmissions
C. Transmission delay
D. Deletion or manipulation of transactions prior to or after establishment of application controls

# Test Taking Tip

Example:

Which of the following represents the GREATEST potential risk in an Electronic Data Interchange (EDI) environment?

A. Transaction authorization
B. Loss or duplication of EDI transmissions
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D. Deletion or manipulation of transactions prior to or after establishment of application controls

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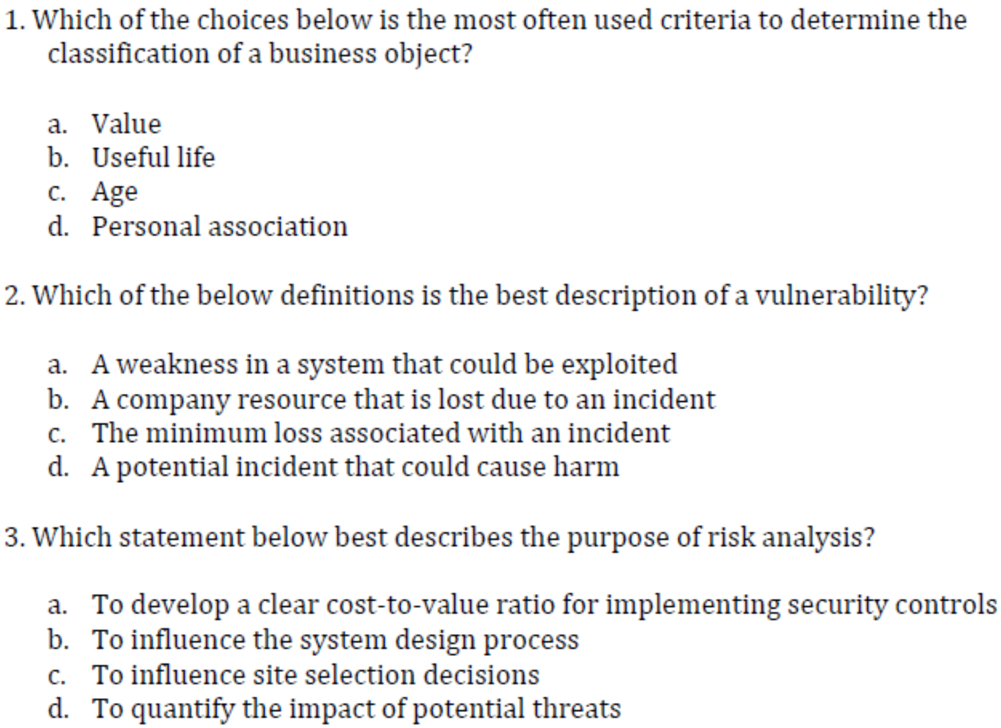
B. Loss or duplication of EDI transmissions
C. Transmission delay
D. Deletion or manipulation of transactions prior to or after establishment of application controls

Answer: A

# Quiz – Week 2



1. Which of the choices below is the most often used criteria to determine the classification of a business object?

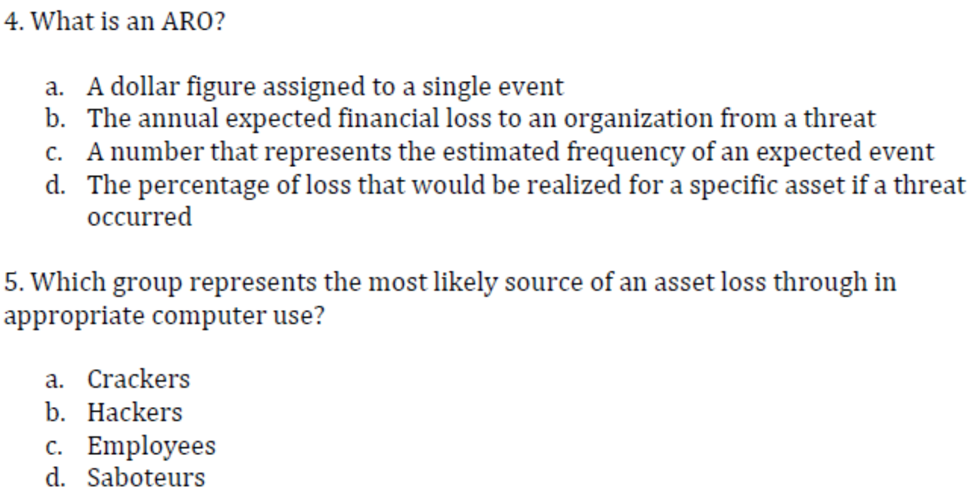
   a. Value
   b. Useful life
   c. Age
   d. Personal association

2. Which of the below definitions is the best description of a vulnerability?

   a. A weakness in a system that could be exploited
   b. A company resource that is lost due to an incident
   c. The minimum loss associated with an incident
   d. A potential incident that could cause harm

3. Which statement below best describes the purpose of risk analysis?

   a. To develop a clear cost-to-value ratio for implementing security controls
   b. To influence the system design process
   c. To influence site selection decisions
   d. To quantify the impact of potential threats



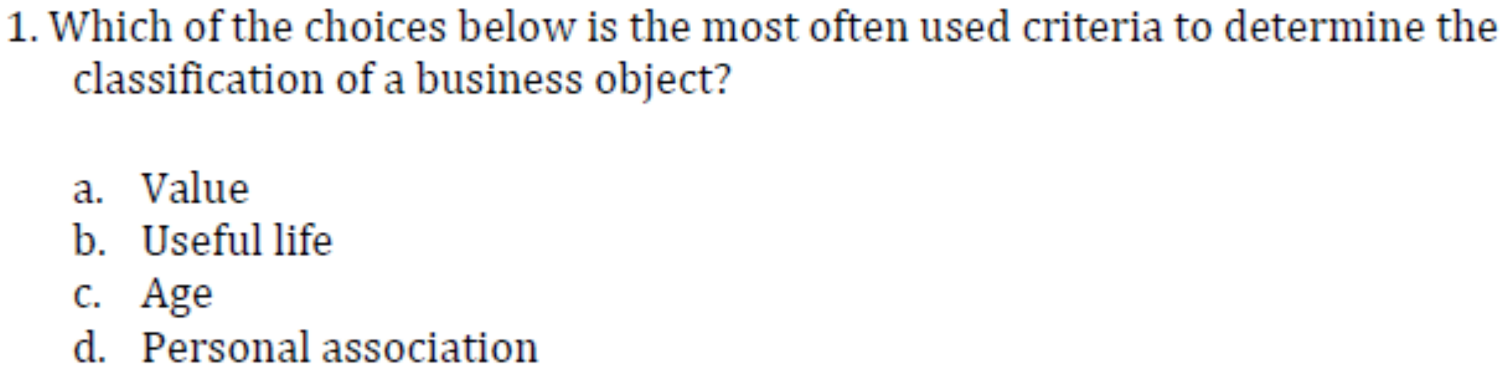
4. What is an ARO?

   a. A dollar figure assigned to a single event
   b. The annual expected financial loss to an organization from a threat
   c. A number that represents the estimated frequency of an expected event
   d. The percentage of loss that would be realized for a specific asset if a threat occurred

5. Which group represents the most likely source of an asset loss through in appropriate computer use?

   a. Crackers
   b. Hackers
   c. Employees
   d. Saboteurs

# Quiz – Week 2



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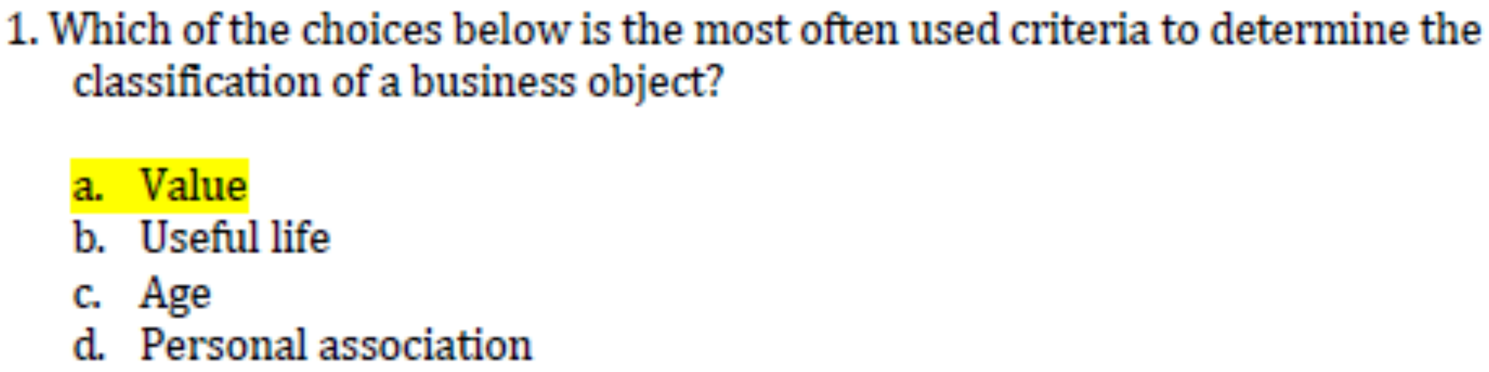

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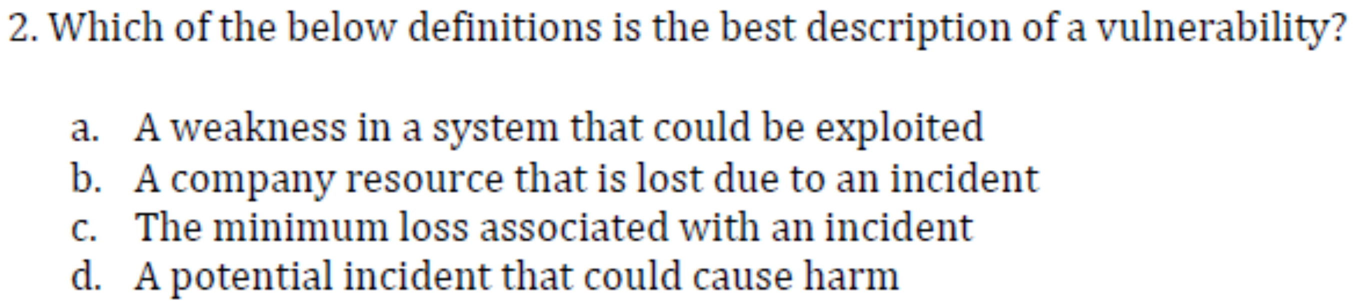

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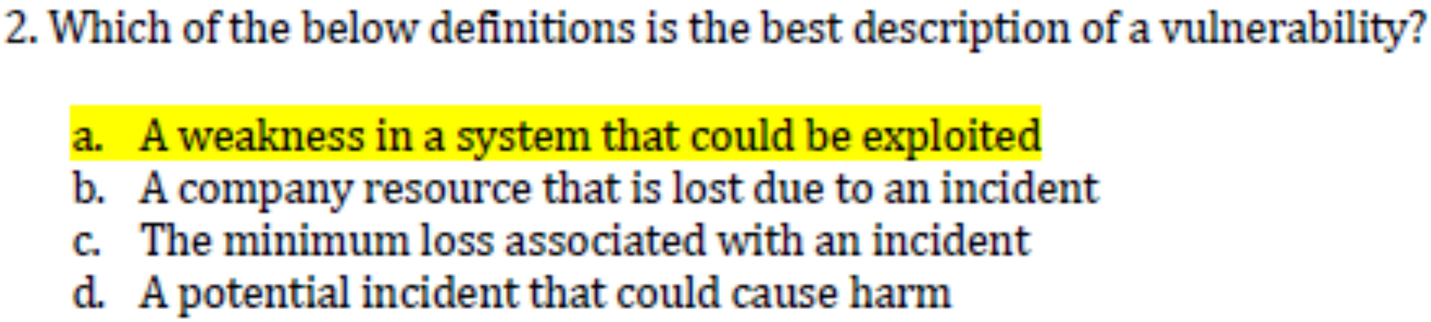

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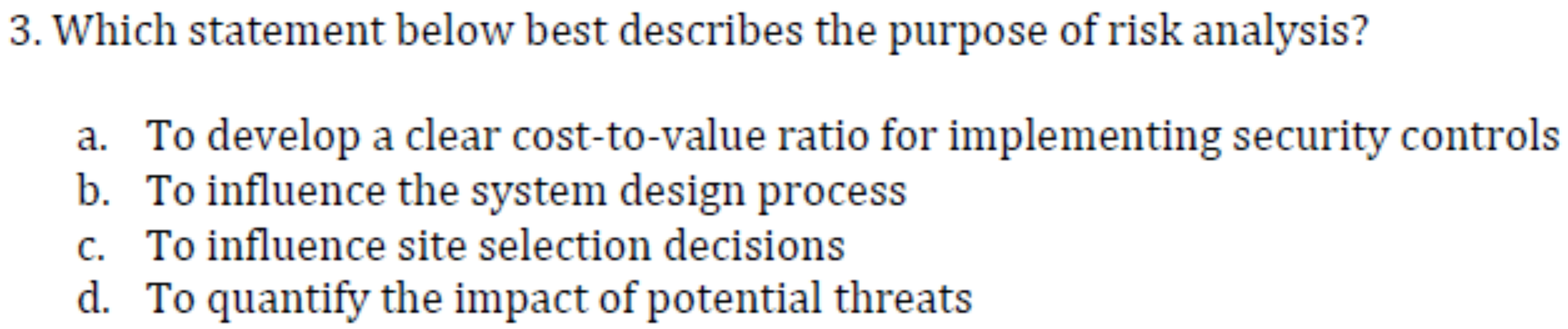

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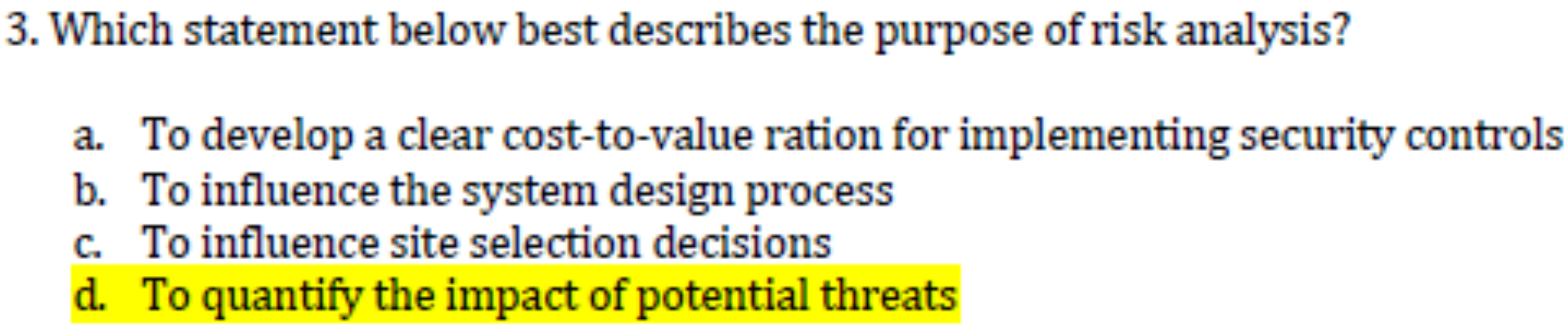

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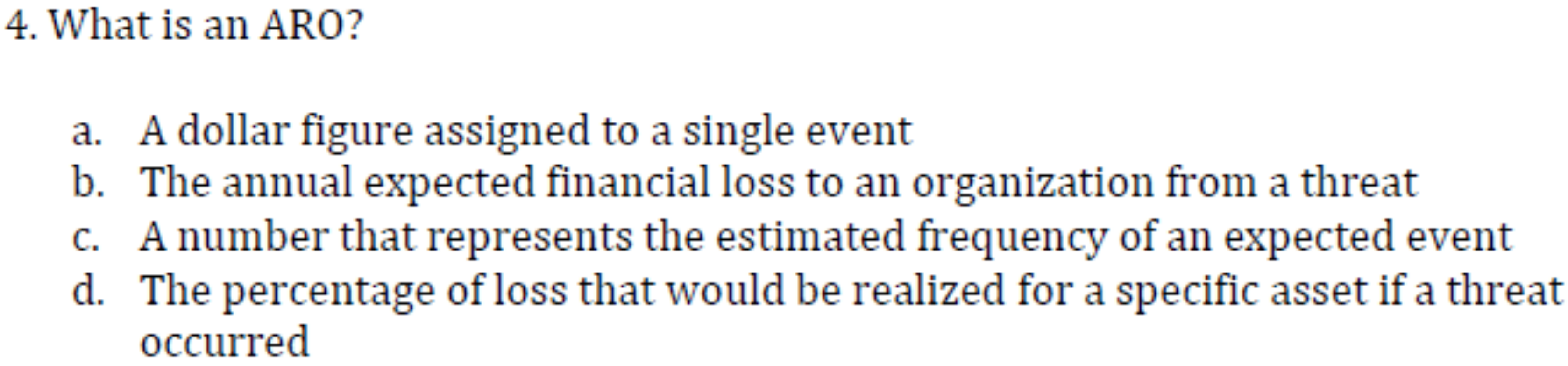

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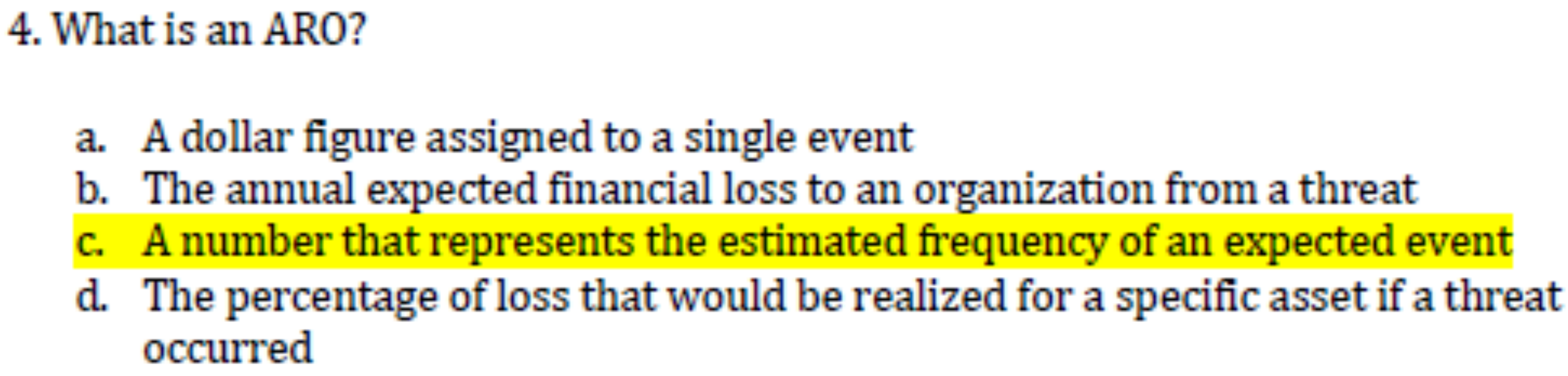

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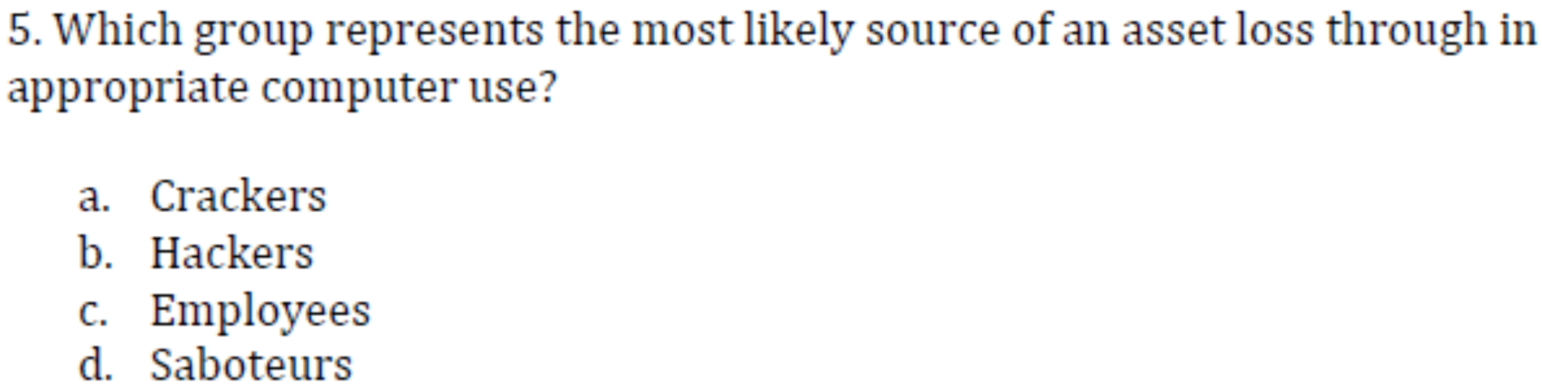

5. Which group represents the most likely source of an asset loss through in appropriate computer use?

a. Crackers
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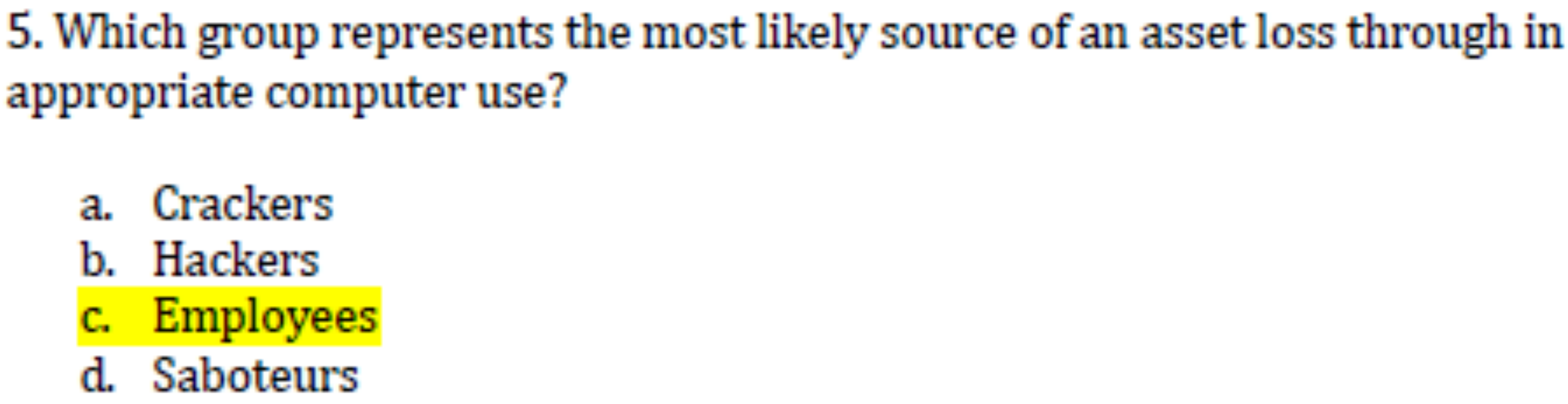
c. Employees
d. Saboteurs

# Quiz – Week 2



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# Test Taking Tip

## *- Look for "subset" questions -*

Often you will encounter questions that ask you to chose the "Best" answer…

The idea is:  At least two of the answers are correct in some sense, but one is "more correct" than the others

It can be useful to view these types of questions as having some possible answers that are actually subsets of the most correct answer

# Test Taking Tip

Example:

An attack that involves an attacker creates a misleading context in order to trick a user into making an inappropriate security-relevant decision is known as:

a) Spoofing attack
b) Surveillance attack
c) Social engineering attack
d) Man-in-the-middle attack

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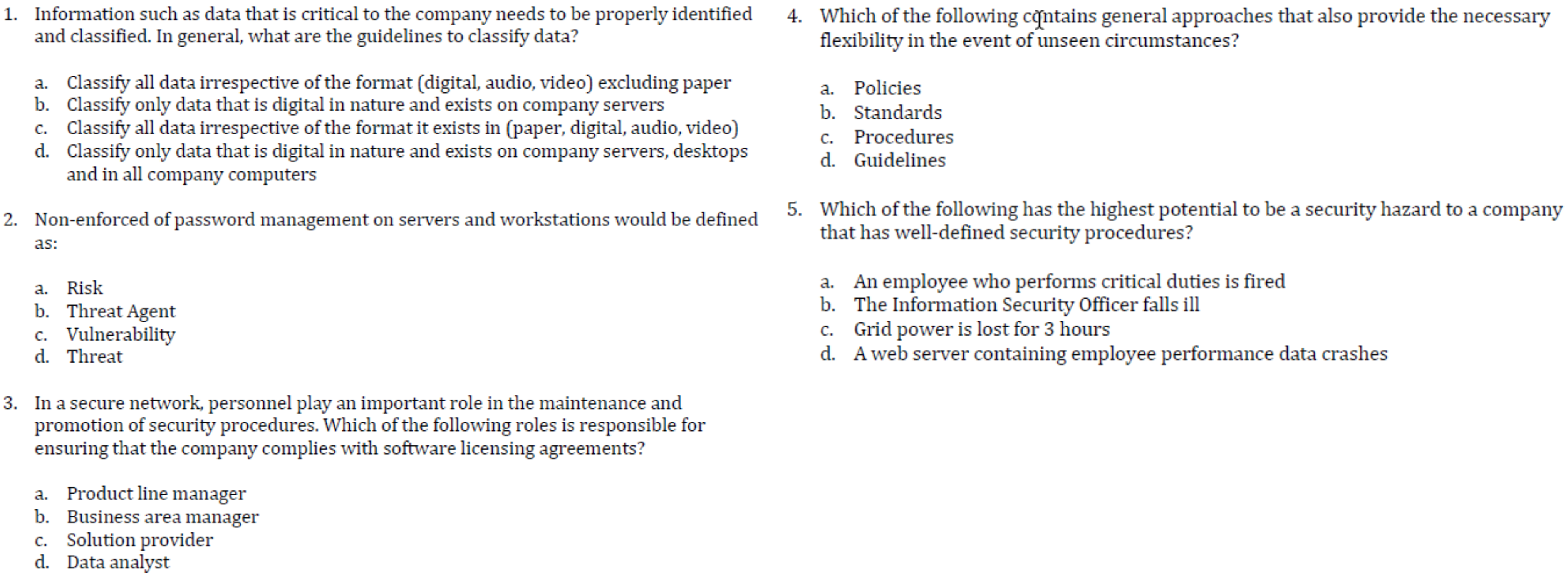
a) Spoofing attack b) Surveillance attack c) Social engineering attack d) Man-in-the-middle attack

Answer: C

# Quiz

# Unit #3 Quiz



1. Information such as data that is critical to the company needs to be properly identified and classified. In general, what are the guidelines to classify data?

   a. Classify all data irrespective of the format (digital, audio, video) excluding paper
   b. Classify only data that is digital in nature and exists on company servers
   c. Classify all data irrespective of the format it exists in (paper, digital, audio, video)
   d. Classify only data that is digital in nature and exists on company servers, desktops and in all company computers

2. Non-enforced of password management on servers and workstations would be defined as:

   a. Risk
   b. Threat Agent
   c. Vulnerability
   d. Threat

3. In a secure network, personnel play an important role in the maintenance and promotion of security procedures. Which of the following roles is responsible for ensuring that the company complies with software licensing agreements?

   a. Product line manager
   b. Business area manager
   c. Solution provider
   d. Data analyst

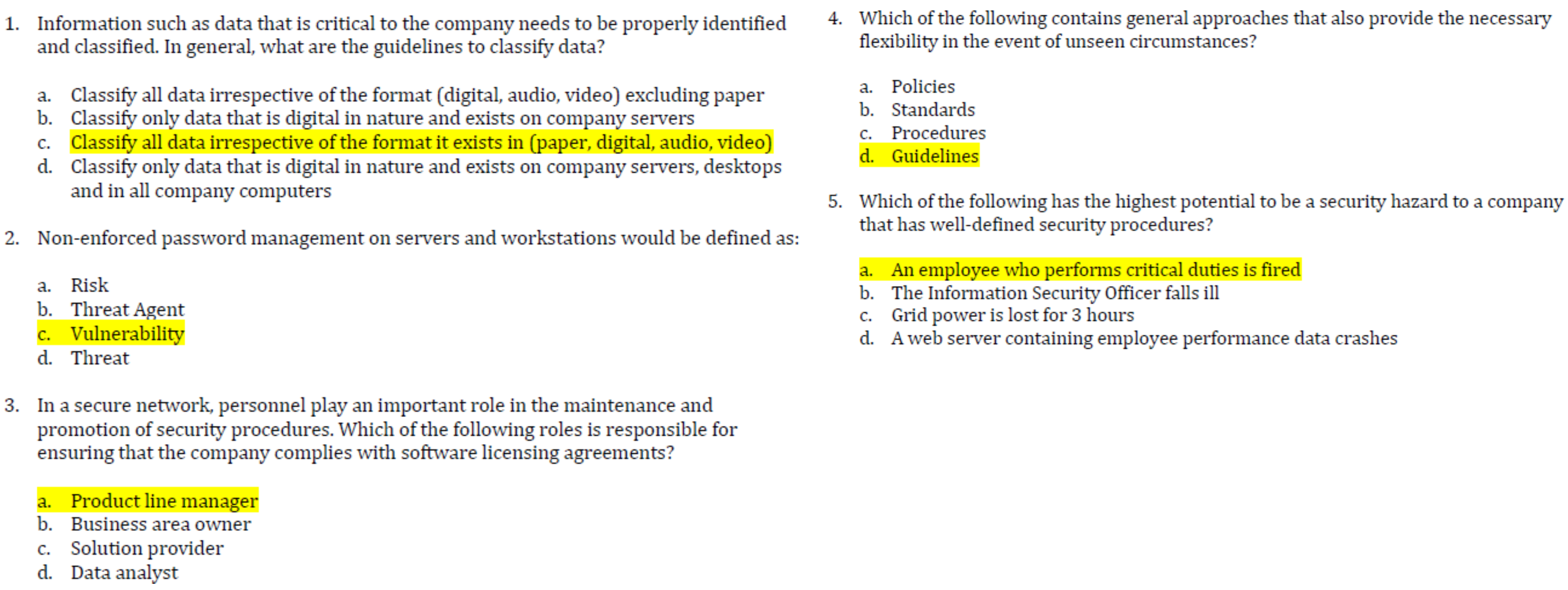
4. Which of the following contains general approaches that also provide the necessary flexibility in the event of unseen circumstances?

   a. Policies
   b. Standards
   c. Procedures
   d. Guidelines

5. Which of the following has the highest potential to be a security hazard to a company that has well-defined security procedures?

   a. An employee who performs critical duties is fired
   b. The Information Security Officer falls ill
   c. Grid power is lost for 3 hours
   d. A web server containing employee performance data crashes

# Unit #3 Quiz Answers



1. Information such as data that is critical to the company needs to be properly identified and classified. In general, what are the guidelines to classify data?

   a. Classify all data irrespective of the format (digital, audio, video) excluding paper
   b. Classify only data that is digital in nature and exists on company servers
   **c. Classify all data irrespective of the format it exists in (paper, digital, audio, video)**
   d. Classify only data that is digital in nature and exists on company servers, desktops and in all company computers

2. Non-enforced password management on servers and workstations would be defined as:

   a. Risk
   b. Threat Agent
   **c. Vulnerability**
   d. Threat

3. In a secure network, personnel play an important role in the maintenance and promotion of security procedures. Which of the following roles is responsible for ensuring that the company complies with software licensing agreements?

   **a. Product line manager**
   b. Business area owner
   c. Solution provider
   d. Data analyst

4. Which of the following contains general approaches that also provide the necessary flexibility in the event of unseen circumstances?

   a. Policies
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# Agenda

- ✓Vocabulary
- ✓Data Classification Process and Models
- ✓Test taking tip
- ✓Quiz