5.1 Introduction

The speed of automation of all activities, whether they be connected to business directly or not has surprised the stakeholders of enterprises, who are affected by such computerization. In our professional work, we realize that our daily jobs have been changed with the help of technology and automated systems. For example- Attendance marking and Tracking systems. Any enterprise located in any remote corner can make their products or services available to anyone, anywhere at any time. New technologies are getting developed due to large scale computerization, decreasing costs of storing data and increasing speed of internet. Emerging technologies such as virtualization, grid computing and cloud delivery model are enabling technology. However, the level of automation needs to be controlled considering the inherent risks of technology.

5.2 Classification of Business Applications

Business Application is defined as a computer program used to fulfill a person’s need for regular occupation or commercial activities like keeping track of inventory levels, checking for bank account balances, checking status of delivery of goods dispatched and all other business activities.
5.2 Applications based on Nature of Processing

- **Batch Processing** - It is defined as a processing of large set of data in a specific way, automatically, without needing any user intervention. The data is first collected, during a work day, for example, and then batch-processed, so all the collected data is processed in one go.

- **Online Processing** - Data is processed immediately while it is entered, the user usually only has to wait a short time for a response. (Example: games, word processing, booking systems). Interactive or online processing requires a user to supply an input. Interactive or online processing enables the user to input data and get the results of the processing of that data immediately.

- **Real-time Processing** - Real time processing is a subset of interactive or online processing. Input is continuously, automatically acquired from sensors, for example, which is processed immediately in order to respond to the input in as little time as possible. After the system is finished responding, it reads the next set of input data immediately to process that.

5.2.2 Applications based in Source of Application

- **Custom-built Application**: Customization involves additional coding while configuration is based on settings which are inputted by the user. Example – Billing, Inventory, Attendance etc.

- **Packaged Software**: These are the standard applications which are not free but are licensed. Customization to suit business requirements may or may not be allowed. For Example - Tally, Oracle 9i, etc.

- **Leased application**: A new method for getting applications is being used today, i.e. leased applications, where user pays fixed rent for using the application for agreed terms.

5.2.3 Applications based on Size and Complexity of Business

- **Small and Medium Enterprise (SME) business**: The best software for small and medium businesses is software designed to help them to run their operations better, cut costs and replace paper processes. The most popular software packages include accounts, office productivity, email and communications, but nowadays, most business activities can be improved through desktop or web-based applications.

- **Large Business**: The business tools that tend to be favored by larger businesses include CRM, for recording customer information and finding out trends in buying habits; and sales force automation, which helpful for organizing and managing sales teams and leads. Business may also choose to use human resources software; business intelligence and dashboard tools; database management systems; and enterprise resource planning and supply chain management tools.
5.3 Information Technology

5.2.4 Business Applications based on Nature of Application


5.3 Business Process Automation

**Business Process:** It is a set of activities that are designed to accomplish specific organizational goals. **Business Process Automation (BPA)** is a strategy to automate business processes so as to bring benefit to enterprise in terms of cost, time and effort.

5.3.1 Objectives of BPA

Confidentiality, Integrity, Availability and Timeliness are the objectives of BPA.

5.3.2 Why BPA?

Following are the primary reasons for automation by enterprises:
- Reducing the Impact of Human Error.
- Transforming Data into Information.
- Improving performance and process effectiveness.
- Making users more efficient and effective.
- Making the business more responsive.
- Improving Collaboration and Information Sharing.
- Cost Saving.
- To remain competitive.
- Fast service to customers.

5.3.3 How to go about BPA?

The steps to go about implementing business process automation are given as follows:

Step 1: Define why we plan to implement a BPA?
Step 2: Understand the rules/regulation under which it needs to comply with?
Step 3: Document the process, we wish to automate.
Step 4: Define the objectives/goals to be achieved by implementing BPA.
Step 5: Engage the business process consultant.
Step 6: Calculate the ROI for project.
Step 7: Development of BPA.
Step 8: Testing the BPA.
### 5.4 Information Processing

*Information* may be defined as processed data, which is of value to the user and is necessary for decision making and survival of an entity as success of business depends upon making right decisions at the right time on the basis of the right information available. The effort to create information from raw data is known as **Information Processing**. Classification of information is based on level of human or computer intervention – Manual Information Processing cycle and Computerized Information Processing Cycle.

### 5.5 Delivery Channels

Delivery channels refer to the mode through which information or products are delivered to users. For example:

**Delivery Channels for Information:** Include Intranet, E-mail, Internal newsletters and magazines; Staff briefings, meetings and other face-to-face communications methods; Notice boards in communal areas; Manuals, guides and other printed resources; Hand-held devices (PDAs, etc.); and Social networking sites like Facebook, WhatsApp etc.

**Delivery Channels for Products:** Include Traditional models, brick and mortar type; Buying from a shop; Home delivery of products; Buying from a departmental store; and Buying online, getting home delivery and making cash payment on delivery etc.

#### 5.5.1 Importance

It is important to have proper and accurate delivery channels for information or product distribution and to consider each of these channels while planning; an overall information management and communications strategy are required.

#### 5.5.2 Information Delivery Channel: How to choose one?

When choosing appropriate delivery channels, one should understand staff needs & environment. It should be more than just the intranet. Further, traditional channel need to be formalized.

#### 5.5.3 Product Delivery Channels: How to choose one?

The customers have moved from purchase of physical books to e-books. This shift has forced business to strategize their delivery channels.
5.6 Controls in BPA

To ensure that all information that is generated from system is accurate, complete and reliable for decision making, there is a requirement for proper controls. Control is defined as policies, procedures, practices and organization structure that are designed to provide reasonable assurance that business objectives are achieved and undesired events are prevented or detected and corrected.

5.6.1 Control Objectives

Major control objectives are - Authorization, Completeness, Accuracy, Validity, Physical Safeguards and Security, Error Handling and Segregation of Duties. The controls are used to Protect, Detect or Correct unlawful events.

- Preventive Control: Those, which prevent occurrence of an error/fraud, say security guards.
- Detective Control: Those, which capture an error, say audit trail.
- Corrective Control: Those, which correct an error or reduce the loss due to error/risk, say insurance policy.

5.6.2 Information Systems’ Controls

Managerial Controls - The controls at this level provide a stable infrastructure in which IS can be built, operated, and maintained on a day-to-day basis.

Application Controls - Application controls are the controls on the sequence of processing events. These controls cover all phases of data right from data origination to its final disposal. Application controls cover transactions as they recorded in each stage of processing into master - parameter and transaction files and include controls relating to transmission and distribution of output through display, electronic media or printed reports. The two are well explained in below pages.

Communication Controls under Application Controls deal with Physical Component Controls like Transmission Media (Guided and Unguided Media), Flow Controls (Simplex, Duplex etc.), Topological Controls (Star, Tree, Ring, Bus). The concept of these is well explained in detail in Chapter - 3 of the study material.

5.7 Emerging Technologies

Various emerging technologies/concepts are given in the following sections:

5.7.1 Network Virtualization

In Information Technology, Virtualization is the process of creating logical computing resources from available physical resources. This is accomplished using virtualization software to create a layer of abstraction between workloads and the underlying physical hardware.
5.6.3 Managerial Functions Based Controls

Types of Managerial Controls and their Objectives

Managerial Control

Top Management and Information Systems Management Controls
Functions performed by a Senior Manager
- Planning: determining the goals of the information systems function and the means of achieving these goals
- Organizing: gathering, allocating, and coordinating the resources needed to accomplish the goals
- Leading: motivating, guiding, and communicating with personnel
- Controlling: comparing actual performance with planned performance

System Development Management Controls
Has responsibility for the functions concerned with analyzing, designing, building, implementing, and maintaining information systems

Concurrent Audit
Auditors assist the team in improving the quality of systems development

Post implementation Audit
Auditors seek to help an organization learn from its experiences in the development of a specific application system

General Audit
Auditors evaluate systems development controls overall

Programming Management Controls
To acquire and implement high-quality programs
- Planning: Using WBS, Gantt Charts, PERT
- Design: Systematic approach to program design

Coding
Using Top-down or bottom-up approach

Testing
Could be Unit Testing, Integration Testing and Whole-of-Program Testing

Operation and Maintenance
Could be Repair Maintenance, Adaptive Maintenance and Perfective Maintenance

Data Resource Management Controls
For data to be managed better users must be able to share data, data must be available to users when it is needed, in the location where it is needed, and in the form in which it is needed.

Security Management Controls
Information security administrators are responsible for ensuring that information systems assets are secure

Quality Assurance Management Controls
Safety-critical systems to improve the quality

Operations Management Controls
Responsible for the daily running of hardware and software facilities

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5.7.2 Grid Computing

In an ideal Grid Computing System, every resource is shared, turning a computer network into a powerful supercomputer. Every authorized computer would have access to enormous processing power and storage capacity. A grid computing system can be as simple as a collection of similar computers running on the same operating system or as complex as inter-networked systems comprised of every computer platform we can think of.

5.7.3 Cloud Computing

Cloud Computing is the use of various services, such as software development platforms, servers, storage, and software, over the Internet, often referred to as the "cloud." The common Cloud Computing Service Models are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

Question 1

What are the objectives of Business Process Automation (BPA)?

Answer

The success of any business process automation shall only be achieved when BPA ensures:

- Confidentiality: To ensure that data is only available to persons who have right to see the same;
- Integrity: To ensure that no un-authorized amendments can be made in the data;
- Availability: To ensure that data is available when asked for; and
- Timeliness: To ensure that data is made available in at the right time.

To ensure that all the above parameters are met, BPA needs to have appropriate internal controls put in place.

Question 2


Answer

<table>
<thead>
<tr>
<th>Manual Information Processing Cycle</th>
<th>Computerized Information Processing Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems where the level of manual intervention is very high. For example- Evaluation of exam papers, teaching and operations in operation theatres.</td>
<td>Systems where computers are used at every stage of transaction processing and human intervention is minimal.</td>
</tr>
</tbody>
</table>

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Question 3

What are the major control objectives in Business Process Automation (BPA)?

Answer

Control is defined as policies, procedures, practices and organization structure that are designed to provide reasonable assurance that business objectives are achieved and undesired events are prevented or detected and corrected. Major control objectives are given as follows:

- **Authorization** – ensures that all transactions are approved by responsible personnel in accordance with their specific or general authority before the transaction is recorded.
- **Completeness** – ensures that no valid transactions have been omitted from the accounting records.
- **Accuracy** – ensures that all valid transactions are accurate, consistent with the originating transaction data, and information is recorded in a timely manner.
- **Validity** – ensures that all recorded transactions fairly represent the economic events that actually occurred, are lawful in nature, and have been executed in accordance with management’s general authorization.
- **Physical Safeguards and Security** – ensures that access to physical assets and information systems are controlled and properly restricted to authorized personnel.
- **Error Handling** – ensures that errors detected at any stage of processing receive prompts corrective actions and are reported to the appropriate level of management.
- **Segregation of Duties** – ensures that duties are assigned to individuals in a manner that ensures that no one individual can control both the recording function and the procedures relative to processing a transaction.
Question 4

What are the characteristics of Cloud Computing?

Answer

The following is a list of some of the characteristics of a cloud-computing environment:

- **Elasticity and Scalability**: Cloud computing gives us the ability to expand and reduce resources according to the specific service requirement. For example, we may need a large number of server resources for the duration of a specific task. We can then release these server resources after we complete our task.

- **Pay-per-Use**: We pay for cloud services only when we use them, either for the short term or for a longer duration.

- **On-demand**: Because we invoke cloud services only when we need them, they are not permanent parts of the IT infrastructure. With cloud services, there is no need to have dedicated resources waiting to be used, as is the case with internal services.

- **Resiliency**: The resiliency of a cloud service offering can completely isolate the failure of server and storage resources from cloud users. Work is migrated to a different physical resource in the cloud with or without user awareness and intervention.

- **Multi Tenancy**: Public cloud service providers often can host the cloud services for multiple users within the same infrastructure. Server and storage isolation may be physical or virtual depending upon the specific user requirements.

- **Workload Movement**: This characteristic is related to resiliency and cost considerations. Cloud-computing providers can migrate workloads across servers both inside the data center and across data centers (even in a different geographic area).

Question 5

Discuss advantages and disadvantages of Cloud Computing.

Answer

**Advantages of Cloud Computing**: It is a cost efficient method to use, maintain and upgrade with almost unlimited storage. It provides an easy access to information and is usually competent enough to handle recovery of information. In the cloud, software integration occurs automatically and the entire system can be fully functional in a matter of a few minutes.

**Disadvantages of Cloud Computing**: This technology is always prone to outages and other technical issues and surrendering all the company’s sensitive information to a third-party cloud service provider makes the company vulnerable to external hack attacks and threats.

Question 6

List out different types of delivery channels through which information is delivered to the user.
5.11 Information Technology

Answer
Delivery channels refer to the mode through which information or products are delivered to users. Delivery Channels for Information include the following:

- Intranet: Network within the company/enterprise;
- E-mail: The most widely used delivery channel for information today;
- Internal newsletters and magazines;
- Staff briefings, meetings and other face-to-face communications methods;
- Notice boards in communal areas;
- Manuals, guides and other printed resources;
- Hand-held devices (PDAs, etc.); and
- Social networking sites like Facebook, WhatsApp etc.

Question 7
Briefly explain Grid Computing. What are possible reasons of using grid computing?

Answer

Grid Computing: Grid Computing is a computer network in which each computer's resources are shared with every other computer in the system. In the ideal grid computing system, every resource is shared, turning a computer network into a powerful supercomputer. With the right user interface, accessing a grid computing system is no different than accessing a local machine's resources.

Some of the reasons of using Grid Computing are as follows:

- Civil engineers collaborate to design, execute, & analyze shake table experiments.
- An insurance company mines data from partner hospitals for fraud detection.
- An application service provider offloads excess load to a compute cycle provider.
- An enterprise configures internal & external resources to support e-Business workload.
- Large-scale science and engineering are done through the interaction of people, heterogeneous computing resources, information systems and instruments, all of which are geographically and organizationally dispersed.

Question 8
What are the components of the Computerized Information processing Cycle?

Answer

The components of a Computerized Information Processing Cycle include the following:

- Input: Entering data into the computer;
• **Processing**: Performing operations on the data;
• **Storage**: Saving data, programs, or output for future use; and
• **Output**: Presenting the results.

**Question 9**

*What are the major process controls, which should be enforced through front end application system, to have consistency in the control process?*

**Answer**

The Process Controls that should be enforced through the front end application system, to have consistency in the control process are as follows:

• **Run-to-Run Totals**: These help in verifying data that is subject to process through different stages. A specific record can be used to maintain the control total.
• **Reasonableness Verification**: Two or more fields can be compared and cross verified to ensure their correctness.
• **Edit Checks**: Edit checks similar to the data validation controls can also be used at the processing stage to verify accuracy and completeness of data.
• **Field Initialization**: Data overflow can occur, if records are constantly added to a table or if fields are added to a record without initializing it.
• **Exception Reports**: Exception reports are generated to identify errors in data processed.
• **Existence/Recovery Controls**: The check-point/restart logs facility is a short-term backup and recovery control that enables a system to be recovered if failure is temporary and localized.

**Question 10**

Write short note on the following:

(a) Network Virtualization
(b) MS Office Applications
(c) **Cryptographic Controls**
(d) **Storage Virtualization**

**Answer**

(a) **Network Virtualization**: In Information Technology, Virtualization is the process of creating logical computing resources from available physical resources. This is accomplished using virtualization software to create a layer of abstraction between workloads and the underlying physical hardware. Network Virtualization allows a large physical network to be provisioned into multiple smaller logical networks and conversely allows multiple physical LANs to be
combined into a larger logical network. This behavior allows administrators to improve network traffic control, enterprise and security.

(b) **MS Office Applications**: These are various office automation systems made available by Microsoft Corporation which include MS Word, MS Excel, MS PowerPoint, MS Access, etc. Each of these software help to achieve automation of various tasks in the office. It has features such as customized ribbon, backstage view, built-in graphics toolset, enhanced security, excel spark lines, pivot for Excel, PowerPoint broadcast, Power Point compression, paste, preview and outlook conversation view.

(c) **Cryptographic Controls**: These controls are exercised in the boundary subsystem and are designed to protect the privacy of data and to prevent unauthorized modifications of data. Cryptography achieves this goal by scrambling data into codes (cryptograms) so that it is meaningless to anyone who does not possess the authentication to access the respective system resource or file. Examples are encryption, digital signature etc.

(d) **Storage Virtualization**: Storage virtualization is the apparent pooling of data from multiple storage devices, even different types of storage devices, into what appears to be a single device that is managed from a central console. Storage virtualization helps the storage administrator perform the tasks of backup, archiving, and recovery more easily - and in less time - by disguising the actual complexity of a Storage Area Network (SAN). Administrators can implement virtualization with software applications or by using hardware and software hybrid appliances. The servers connected to the storage system aren’t aware of where the data really is. Storage virtualization is sometimes described as “abstracting the logical storage from the physical storage”.

**Question 11**

**Define ‘On-line processing’ and ‘Real-time processing’.**

**Answer**

**Online Processing**: In this, data is processed immediately while it is entered, the user usually only has to wait a short time for a response. (Example: games, word processing, booking systems). Interactive or online processing requires a user to supply an input. Interactive or online processing enables the user to input data and get the results of the processing of that data immediately.

**Real-time Processing**: Real time processing is a subset of interactive or online processing. Input is continuously, automatically acquired from sensors which are processed immediately in order to respond to the input in as little time as possible. The system doesn't need a user to control it. Real time processing is used in warning systems on aircraft, alarm systems in hazardous zones, burglar alarms etc.
Question 12
Describe the Information Systems Management Control usually performed by the Top Management.

Answer

Top Management and Information Systems Management Controls: Top management must ensure that information systems function is well managed. It is responsible primarily for long-run policy decisions on how Information Systems will be used in the organization. Information Systems management has overall responsibility for the planning and control of all information system activities.

It also provides advice to top management in relation to long-run policy decision making and translates long-run policies into short-run goals and objectives. The senior managers who take responsibility for Information System function in an organization face many challenges. The major functions that a top/senior manager must perform are as follows:

- **Planning** – determining the goals of the information systems function and the means of achieving these goals;
- **Organizing** – gathering, allocating, and coordinating the resources needed to accomplish the goals;
- **Leading** – motivating, guiding, and communicating with personnel; and
- **Controlling** – comparing actual performance with planned performance as a basis for taking any corrective actions that are needed.

Top management must prepare two types of information systems plans for the information systems function: **Strategic Plan** and an **Operational Plan**. The Strategic Plan is the long-run plan covering, say, the next three to five years of operations whereas the Operational Plan is the short-plan covering, say, next one to three years of operations.

Question 13
Discuss the constraints that need to be taken into consideration while developing a secured Grid Architecture.

Answer

To develop a secured Grid architecture, following constraints are needed to be taken into consideration:

- **Single Sign-on**: A user should authenticate once and they should be able to acquire resources, use them, and release them and to communicate internally without any further authentication.
- **Protection of Credentials**: User passwords, private keys etc. should be protected.
• **Interoperability with local security solutions:** Access to local resources should have local security policy at a local level. Despite of modifying every local resource there is an inter-domain security server for providing security to local resource.

• **Exportability:** The code should be exportable i.e. they cannot use a large amount of encryption at a time. There should be a minimum communication at a time.

• **Support for secure group communication:** In a communication, there are number of processes which coordinate their activities. This coordination must be secure and for this there is no such security policy.

• **Support for multiple implementations:** There should be a security policy which should provide security to multiple sources based on public and private key cryptography.

**Question 14**

Discuss the constraints that need to be taken into consideration while developing a secured Grid Architecture.

**Answer**

To develop a secured Grid architecture, following constraints are needed to be taken into consideration:

• **Single Sign-on:** A user should authenticate once and they should be able to acquire resources, use them, and release them and to communicate internally without any further authentication.

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• **Support for multiple implementations:** There should be a security policy which should provide security to multiple sources based on public and private key cryptography.

**Question 15**

Explain the concept of Virtualization. Enumerate major applications of Virtualization.

**Answer**

Virtualization: In computing, Virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where...
the framework divides the resource into one or more execution environments. Virtualization refers to technologies designed to provide a layer of abstraction between computer hardware systems and the software running on them. The core concept of Virtualization lies in Partitioning, which divides a single physical server into multiple logical servers. Once the physical server is divided, each logical server can run an operating system and applications independently.

Major applications of the concepts of the virtualization are as follows:

- **Server Consolidation**: Virtual machines are used to consolidate many physical servers into fewer servers, which in turn host virtual machines. Each physical server is reflected as a virtual machine "guest" residing on a virtual machine host system. This is also known as “Physical-to-Virtual” or 'P2V' transformation.

- **Disaster Recovery**: Virtual machines can be used as "hot standby" environments for physical production servers, i.e. changes “backup-and-restore” philosophy, by providing backup images that can "boot" into live virtual machines, capable of taking over workload for a production server experiencing an outage.

- **Testing and Training**: Virtualization can give root access to a virtual machine. This can be useful in kernel development and operating system courses.

- **Portable Applications**: Portable applications are needed when running an application from a removable drive, without installing it on the system's main disk drive. Virtualization can be used to encapsulate the application with a redirection layer that stores temporary files, windows registry entries and other state information in the application's installation directory and not within the system’s permanent file system.

- **Portable Workspaces**: Recent technologies have used virtualization to create portable workspaces on devices like iPods and USB memory sticks.

**Exercise**

1. Discuss some of the applications that help enterprise to achieve Business Process Automation.
2. How can controls be classified based on the time at which they are applied?
3. Discuss the steps involved in implementing Business Process Automation.
4. Define the following terms in brief.
   (a) Cloud Computing
   (b) Grid Computing
   (c) Control in BPA
5.17 Information Technology

5. Discuss the major parameters that need to be considered while choosing an appropriate delivery channel for information.

6. Discuss Boundary Controls and Communication controls in detail.

7. What do you understand by Database Controls under Application Controls? Discuss in brief.

8. Differentiate between Input Controls and Output Controls.