

# FACTFILE: GCE DIGITAL TECHNOLOGY

## AS2: FUNDAMENTALS OF DIGITAL TECHNOLOGY

### PROCESSING SYSTEMS

#### Learning Outcomes

Students should be able to:

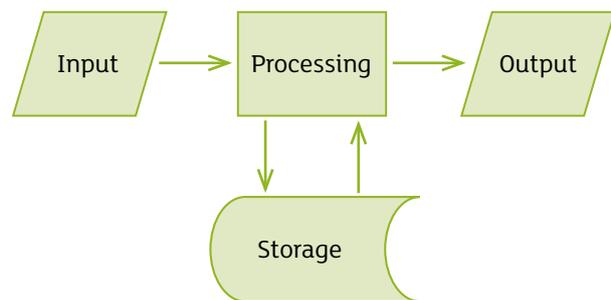
- describe batch processing and real-time processing; and
- evaluate the use of batch processing and real-time processing for common applications.
- describe the input, output and processing involved in a range of common devices: automatic teller machines (ATMs), point of sale (POS) terminals and smartphones;

#### Content in Implementation Fact File

- ✓ Batch and real-time processing
- ✓ Evaluating processing systems for applications
- ✓ Input, output processing in common devices
  - Automated teller machines (ATM)
  - Point of sale terminals (POS)
  - Smartphones
- ✓ Questions

#### Batch and real-time processing

Data processing is what happens when raw data is input into a computer system, manipulated (or processed) in some way and then output as useful information. Examples of processing include, searching for data, sorting data or performing calculations.



A range of processing modes or type of processing can be applied to a computer based task. The mode selected will be decided at the design stage in system development. Some of the modes of processing available include:-

#### Batch processing

In batch processing systems, all the data to be input is collected together as a single batch. Processing does not occur until all of the data has been collected and then it is all processed in one go. Often there may be a time delay between the input and the processing of the data. Since a large amount of data is to be processed at once the batch processing normally occurs during downtime for the main computer system, i.e. it is normally carried out when the processor is not being accessed or used by other users.

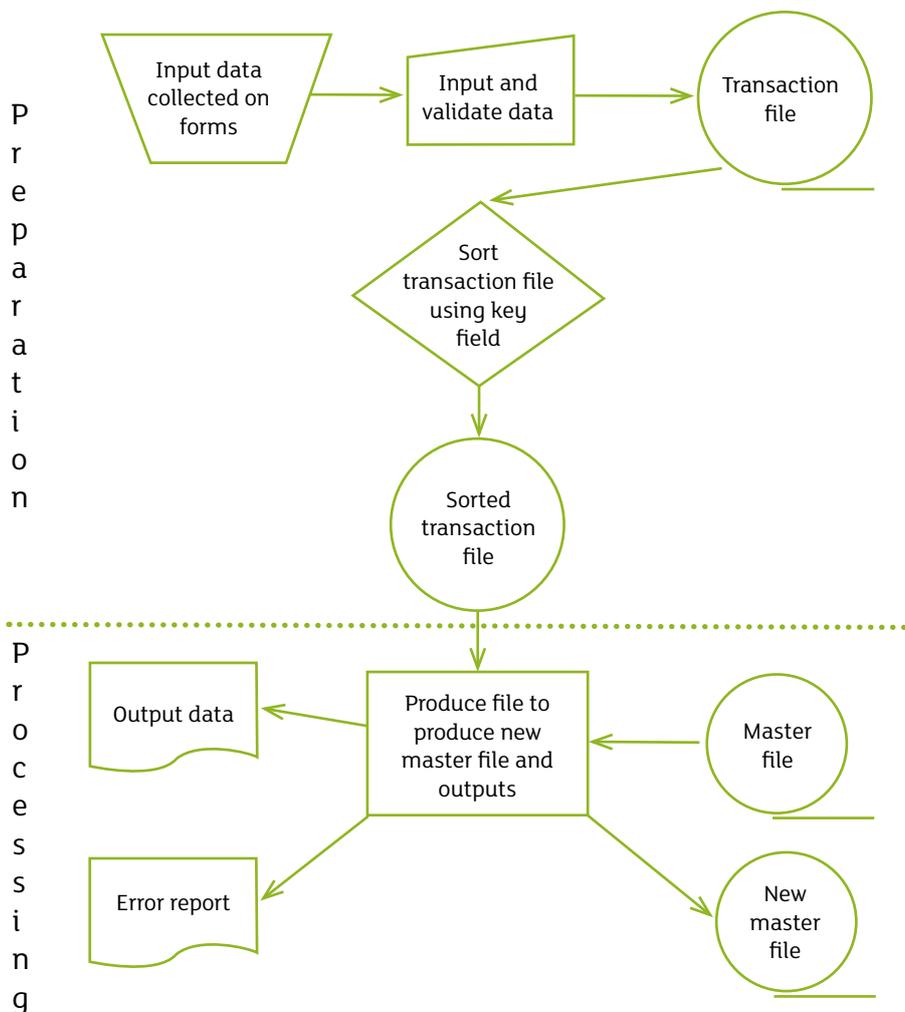
Batch processing systems hold the main records for the system in a file called a master file. The master file will be sorted normally by key field. Any new data to be input to the system (any new transactions) will be stored on a separate file called a transaction file until the whole batch of transactions are ready for processing.

Before the transactions can be processed the records on the transaction file must be sorted into the same order as those stored on the master file. This will help speed up the processing of the data as time is not wasted searching for matching records on the master and transaction files. The data on the transaction file must also be validated; this is normally carried out by a human operator during the data entry process. Validation helps minimise

the likelihood of the batch process failing. This is important as processing is normally carried out overnight and without human intervention so if an invalid process is encountered it could stop the entire process.

During batch processing the master file and the transaction file are merged to create a new updated master file. At the end of the process a report will also be generated for the user to highlight any transactions that could not be processed for some reason.

The diagram below illustrates what happens during batch processing



**Real-time processing**

In some situations it is important that data is processed quickly enough to meet a real world deadline. A real-time system is one that can react fast enough to influence behaviour in the outside world. Examples include warning systems on air craft or missile guidance systems where flight paths must be monitored and altered instantly. Consider the speed of travel of an aircraft or a missile. Inputs relating to the flight path must be input and processed at high speed if the air craft or missile is to response to changes in environment. Most real-time systems are control system similar to the examples given above. These systems will incorporate sensors for input so that data is obtained and input without delay. Once the input data is processed instructions will be issued to control devices with regards to the actions they need to take.

Applications where tasks are completed at fixed intervals, without a need for immediate feedback and where all transactions are processed in the same way are best suited to batch processing methods, for example billing systems, payroll, and production of utility bills.

In situations where output from a process must be made available in a timely manner then the developer must weigh up the pros and cons of all processing modes when making a decision regarding the most appropriate method for the application being developed.

**Evaluating processing systems for applications**

Some applications are best suited to batch processing whilst others where immediate feedback is required are better suited to real-time processing. At the design stage the development team will have to weigh-up the pros and cons of each method of development to decide which mode best suits the application they are designing and implementing.

Method of Processing	Advantages	Disadvantages
Batch processing	<ul style="list-style-type: none"> <li>• Can be carried out overnight without human intervention</li> </ul>	<ul style="list-style-type: none"> <li>• Master file is not always up-to-date so not suitable for some applications for example holiday reservation sites, flight booking and so on</li> <li>• Delay between input and output being made available</li> </ul>
Real-time processing	<ul style="list-style-type: none"> <li>• Input data is processed almost immediately (without any significant delay)</li> </ul>	<ul style="list-style-type: none"> <li>• System down time impacts processing immediately</li> </ul>

## Input, output and processing in common devices

Many of the devices we interact with on a daily basis can be considered to be processing systems with input and output devices which support user interaction and feedback. We will examine some of the more common examples here.

### Automated Teller Machines (ATM's)

ATMs such as the one shown below have a variety of input and output devices.

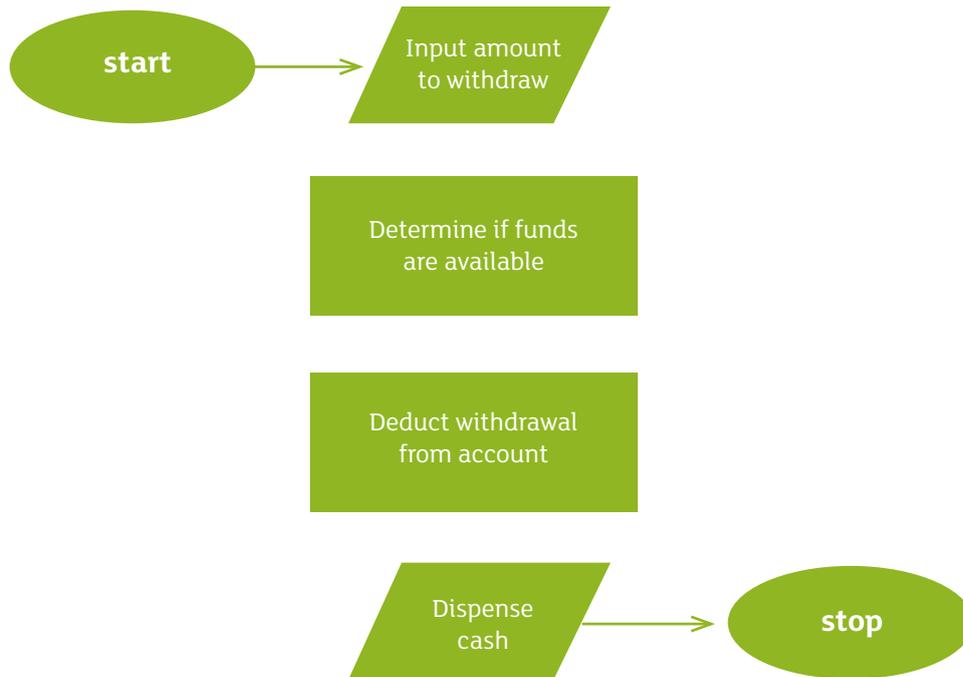


ATM devices have two main input devices. These include the card reader which reads information regarding the user's account from the magnetic strip or processing chip on the customer's bank card. Information stored on the customer's card is used to locate the customer's account details in order to complete the transaction the customer has requested at the ATM. The second main input device is the keypad which is made available to the user to allow them to enter details such as their PIN number, details on the amount of money involved in the transaction or to allow them to select options regarding the type of transaction they wish to initiate. More often than not the key pad may now be incorporated into the output screen display through the use of a touch sensitive screen. Users

can then select options on the screen or use a numeric keypad presented on the screen to enter details regarding their transaction.

In terms of output devices the ATM will use a display screen to present prompts to the user regarding the information to be collected in order to allow them to complete the transaction. As was previously mentioned the screens in many ATM's are now touch sensitive and can operate with a dual function, i.e. as input and output devices. Additional output devices provide further feedback for the user, for example will provide printed feedback in the form of a receipt from a low quality printer and auditory feedback when an incorrect option has been selected or a key is pressed on the keypad.

The type of processing carried out at an ATM will depend greatly upon the type of transaction selected by the user. The most common operation is the withdrawal of money and the flow chart below illustrates this process.



## Point of sale terminals

Point of sale terminals similar to the one shown below are now common place in our supermarkets.



Such terminals provide the end user with a range of hardware devices to support input and output.

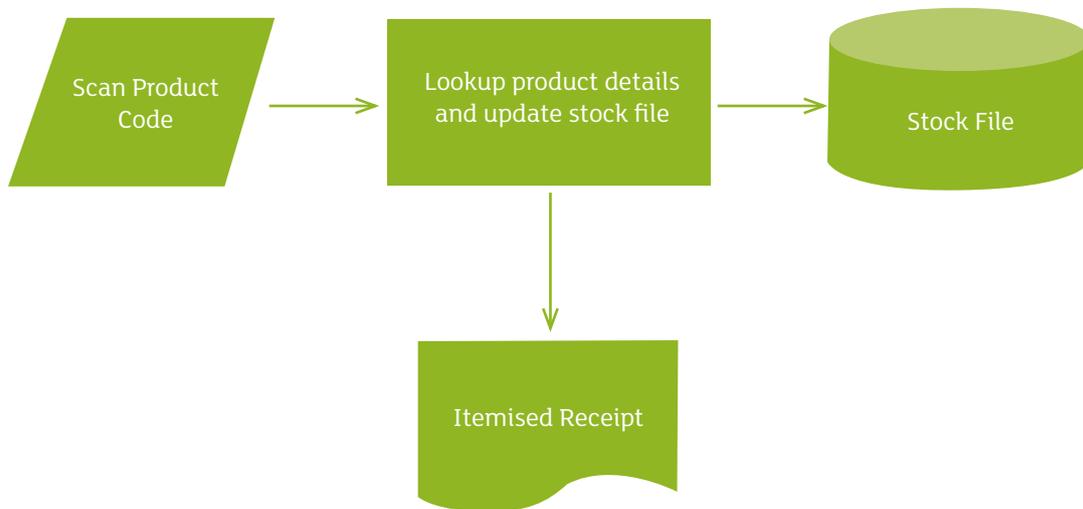
A typical POS will have a range of input devices to facilitate recording details with regards to the purchases being made and the method of payment for the products. Some of these input devices include:–

- Bar-code scanners support the direct input of the product code, this can then be used to locate additional information regarding the product in the stores database.
- Numeric keypads are available to support manual entry of data regarding quantities purchased or money paid for the transaction.
- Scales are now available on many POS systems where the weight of a product is automatically recorded and can then be used to calculate a total cost based on the price per unit weight.
- Card readers with numeric keypads allow the system to accept electronic payment for goods following the entry of a PIN (personal Identification Number).
- Many POS terminals now contain antenna to support contactless payment from cards and devices using Radio Frequency Identification (RFID) or near field communication (NFC).

In terms of output POS systems will provide feedback to the user using a variety of devices, examples of which include:–

- Auditory feedback on the success or failure of a product scan will be provided via speakers
- Monitors provide feedback to the user in the form of individual product prices, a running total for the transaction, and details on the amount of money tendered and change to be provided in addition to prompts for the customer to enter PIN details to allow for a secure transaction to take place.
- Printing devices will also provide customers with an itemised receipt.

An overview of the processing carried out at a POS terminal is provided below.



### Smart Phones

We are all familiar with the concept of a smart phone in today's technologically advanced era and we have a wide range of models to choose from.



scanrail / iStock / ThinkstockPhotos

Despite their differing appearances most models have a range of common input and output devices available to support user interaction.

Most smart phones will have a touch sensitive screen which will support input and output at the same time and in many cases the keypad is also integrated into the mobile phone. Many users have now sidestepped the traditional keyboard as a means of entry using mobile phones and instead make use of microphones and voice recognition software when entering instructions to a smart phone while high resolution cameras are now also available to support video and image capture.

Text entry is still a huge part of our interactions with smart phone devices and most users will have more than one type of keyboard at their disposal to support text entry. For many the standard QWERTY

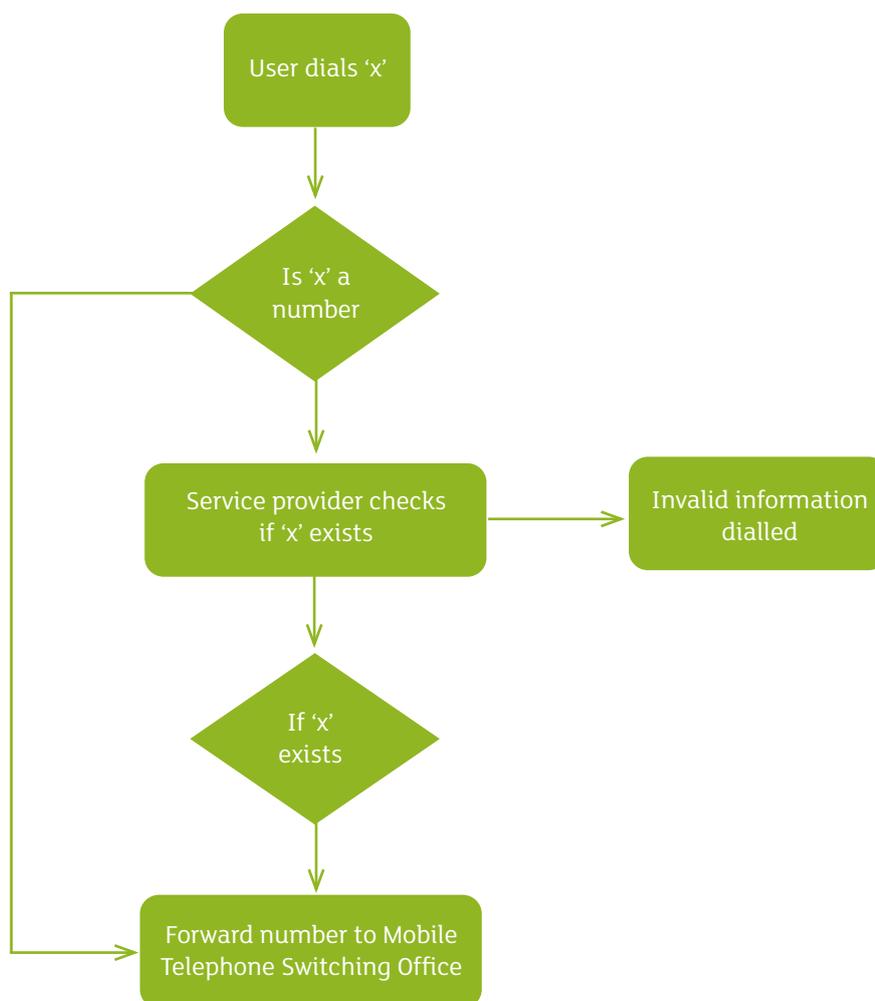
keyboard will suffice but most smart phones provide users with the ability to switch between it and other specialised keyboards. Selection of characters on the keyboard or indeed on the main smartphone interface can be completed using a range of methods and the choice made tends to be down to user preference. Some users prefer to use their fingers to select available options while others prefer styles-based entry. For those playing games on their smart phones data entry may be supported through the use of motion sensors which can detect tilts made to the angle of the phone in response to on-screen movement perhaps in a driving game. Touch screen gestures are now also a common means of interaction with smart phone devices where combinations of on screen flicks, drags and multi-touch pinches for example can lead to apps being closed or minimised or images being resized on screen.

When considering the input devices associated with our mobile phones consideration also needs to be given to the role played by the GPS (Global Positioning System) receiver found on mobile phones. The GPS chip will “listen” for data from your mobile phone provider and satellites to help determine a ‘fix’ on your location for use with certain specialised apps.

The liquid crystal display on smart phones which support user interaction in terms of input and output it offer the user the advantage of low power consumption and flicker free imaging. In addition it is cheap and light so it easily supports the portability of smart phone devices. They are not without their disadvantages including dead pixels and the inability to adjust pixel resolution if need be.

Additional user feedback is also provided to the smart phone user in audio format via a speaker and in haptic format for example using vibrations. The type of feedback provided tend to be task (or app) specific and in many cases more than one method of feedback will be used to alert the user to the device when an action has occurred which requires attention, for example a text message alert may include an on-screen banner alert, sound output and vibration. The provision of multimode output allows the user to select the method of output which best suits them; especially if they are involved in other tasks.

Much of the processing associated with smartphone use tends to be app specific but the example below outlines the basic processing involved in entering a value using the keypad on a smartphone



## Questions

- 1** Transaction files and master files are used to store data in batch processing systems. Describe how each file is used in batch processing. [4]

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- 2** Describe two ways transaction files are manipulated prior to being used to update the master file in a batch processing system. [6]

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**3** Identify 3 output devices associated with a POS terminal and describe how they are used to provide feedback to the end user.

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**4** Produce an algorithm or flowchart to illustrate how a POS terminal can be used to keep stock levels up-to-date in a supermarket.

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5 Describe two methods of input available to the user of a smart phone using a touch sensitive screen.

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6 Calendars on smartphones can be used to set alerts to remind users of important tasks. Use an algorithm to describe the process associated with the issuing of an alert to a user when a calendar event needs to be highlighted with an alert sound.

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Bibliography  
BCS Academy Glossary Working Party, 2013, *BCS Glossary of Computing and ICT*, 13<sup>th</sup> Edition, Swindon, BCS Learning and Development Ltd

