



College of Business and Economics

**School of Consumer Intelligence and
Information Systems**

Department of Applied Information Systems

Learning Guide

Development Software 3A DSW03A1

Mr Sandile Thamie Mhlanga

2023

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1 Introduction

1.1 Welcome

Welcome to the DSW03A1 (Development Software 3A) semester module for Semester 1, 2023. This learning guide is designed to assist you through this course and will guide you with preparation for classes, assignments and tests.

Please note that Module DSW03A1 and DSW03B1 are independent modules, therefore you must pass all modules with at least 50% to pass the overall Development Software subject. An integrated teaching and learning approach is followed in this module. This means that learning is facilitated by more than one support resource, e.g., textbook, face-to-face contact with tutors, lectures, Blackboard, this learning guide and any other additional reference material – each of which is complementary to the other.

1.2 School Information

School Name	School of Consumer Intelligence and Information Systems
Director	Prof Mercy Mpinganjira
School Secretary	Fareea Dangor
Contact Details	+27 (0) 11 559 3200 fdangor@uj.ac.za C Ring 601 Auckland Park Kingsway Campus

Table 1: School Information

1.3 Department Information

Department Name	Applied Information Systems
Head of Department	Dr Stella Bvuma
Department Secretary	Dr Martha Winter
Contact Details	+27 (0) 11 559 1139 marthaw@uj.ac.za G Purple 4 Auckland Park Bunting Road Campus

Table 2: Department Information

1.4 Academic Coordinator Information

Academic Coordinator	Ms Nomusa Mtshali
Contact Details	+27 (0) 11 559 1375 nomusas@uj.ac.za D Red 4 Auckland Park Bunting Road Campus

Table 3: Academic Coordinator Information

1.5 Lecturer Information

Module Lecturer	Mr Sandile Thamie Mhlanga
Contact Details	+27 (0) 11 559 1366 smhlanga@uj.ac.za D Green 2 Auckland Park Bunting Road Campus

Table 4: Lecturer Information

1.6 Library Services and Resources

The UJ Library offers a range of information services and resources contained in subject-specific guides, for detailed Library information, go to <https://www.uj.ac.za/library/>

These guides include various important topics that will make your academic journey easier, some of the topics covered in the course include:

- Assignment help
- How to search for books and journal articles
- How to avoid plagiarism
- How to formulate research strategies?
- Learn to evaluate information on the internet to avoid misinformation.

To get in touch or contact your friendly Information Specialists (Librarians) get our full details and relevant departments here:

<https://uj.ac.za.libguides.com/c.php?g=581172&p=9507910>

Highly Recommended guides:

The College generic guide https://uj.ac.za.libguides.com/?group_id=12172

Prescribed and Recommended Books:

<https://uj.ac.za.libguides.com/c.php?g=1217108>

Past Exam Papers (Online) <https://uj.ac.za.libguides.com/c.php?g=1222441>

Postgraduate information services:

<https://uj.ac.za.libguides.com/c.php?g=1211691>

How to find journal articles:

<https://uj.ac.za.libguides.com/c.php?g=581172&p=4011460>

Online Information Literacy Module

<https://uj.ac.za.libguides.com/c.php?g=581225>

The Postgraduate Research Navigator (Start to Finish):

<https://uj.ac.za.libguides.com/c.php?g=938500>

1.7 Purpose and Use of This Learning Guide

The purpose of this learning guide is to provide students with important administrative, organisational and module information and as such, a frame of reference and road map to guide students in their planning and preparation in this module through the semester. It is of critical importance that students continually refer to the learning guide throughout the semester.

This learning guide and all other supporting resources are not substitutes for lectures (**Theory Sessions**) / tutorials (**Practical Sessions**). The learning guide, other learning material, lectures, assessments and other activities comprise an inclusive and integrated learning experience aimed at achieving the outcomes of this module. **ATTENDANCE**

AT LECTURES IS CRUCIAL as lectures do not only allow for more guidance and direction regarding the scope of the module, but also allow for meaningful engagement which is expected to facilitate an in-depth understanding of the core issues covered in the module.

1.8 Student Conduct

Academic honesty and general ethical behaviour is important for the holistic development of an individual, particularly in the early years of student life.

UJ does not tolerate plagiarism of any type, and sanctions are applied to offenders. For more information and the complete Student Plagiarism Policy document, follow the appropriate link on this module's Blackboard site. See also Section 3.14 of this learning guide.

UJ has developed an extensive policy framework, in order to enhance the teaching and learning experience of its students. This policy framework has implications for both teaching staff and for students. Please note that it is your responsibility to be familiar with these policies:

- UJ Academic Regulations
- Student Charter: Rights and Responsibilities
- UJ Assessment Policy

Links to some of these as well as other important policies are given on this module's Blackboard site.

2 Module and Programme Information

2.1 The Place of the Programme in the Academic Disciplinary Progression

This module is part of the Diploma in Business Information Technology (DI1401) programme, which is offered by the School for Consumer Intelligence and Information Systems in the College of Business and Economics.

The purpose of the programme is to develop the applied competence of students in developing, analysing, interpreting and applying information technology business management principles and methods. The programme prepares students to meaningfully contribute to the effective and efficient business management of information technology in organisations.

On completion of the programme students will be able to demonstrate competence in: •

analysis and understanding of the interdependency between business and Information Technology

- making decisions and accepting responsibility
- communicating effectively using models, visual and language skills
- working effectively in a team
- collecting, organising and critically evaluating information in order to assess the situation correctly
- demonstrating an understanding that the problem-solving contexts do not exist in isolation and therefore look at the system as a whole

2.2 Module Name, Code, NQF Level, NQF Credits and Prerequisites

Module Name	Development Software 3A
Module Code	DSW03A1
NQF Level	6
NQF Credits	16
Prerequisites	None

Calculated according to notional hours.

Table 5: Module NQF Information

2.3 Module Purpose and Outcomes

The purpose of this module is to develop students who can demonstrate their knowledge in the implementation of application solutions using current Windows and web technology. Set against the backdrop of the Fourth Industrial Revolution (4IR) and its enabling technologies, the major emphasis will be on developing and implementing Windows solutions using the latest technologies. By the end of the module, students should be able to:

- create and use help files in a project and implement the project
- use snippets correctly
- develop and implement multi-tier programs
- manipulate database in multiple ways in a program
- design and implement a program to read from and write to flat files and use the file system
- create a website that successfully maintains state and uses different navigation techniques including XML documents
- create and consume a web service

3 Administrative and Organisational Information

3.1 Prescribed Textbook

There is no prescribed textbook for this module, however, various other resources (including library e-books, video clips, websites, and tutorials, amongst other material) will be referenced from time to time.

3.2 Semester Work Schedule

For a detailed account of the work schedule for the semester, please refer to Learning Unit 0, *Introduction and Administration Matters* on this module's Blackboard site. This is an administrative Learning Unit which contains additional handy information and details regarding all the administration and logistics for this module. An important document which forms part of this Learning Unit is the **Module Schedule**. This is a live document for the entire semester that outlines the module's roadmap, including important dates and submissions.

The module's timetable is also an important component. See Table 6 for this module's semester timetable.

Session Type	Day & Period	Time	Venue
Practical Session	Tuesday	08:00 – 09:40	Con Cowan G10
Practical Session	Thursday	08:50 – 10:20	Con Cowan G15
Practical Session	Thursday	10:30 – 12:10	G Red 3C
Practical Session	Friday	08:00 – 09:40	Con Cowan G01
Theory Sessions	Wednesday	09:40 – 11:20	J Purple 10

Table 6: Module Semester Timetable

3.3 Tutorial Arrangements

Practical Sessions (i.e. tutorials) will be held on dates and venues mentioned according to table 6 (see Section 3.2). The sessions should give enough opportunity for students to interact with the tutor(s) in order to clarify any questions or concepts that may have been missed during the **Theory Sessions**.

3.4 Class and Tutorial Attendance

Attending both **Theory Sessions** and **Practical Sessions** is an important aspect of this module. Although not compulsory, it remains in your own best interest to attend all scheduled sessions. It is a known fact that regular attendance increases the success of a student.

In particular, students are required to attend a minimum of 80% of all scheduled classes (this includes both the **Theory Sessions** and **Practical Sessions**). See **Academic Regulations, Par 5.11, Class Attendance**.

Attendance registers are taken in this module, and your attendance record is taken into consideration, when unsatisfactory progress is being considered, for instance should you need to apply for special consideration for admission to an exam or assessment.

Refer to Learning Unit 0, *Introduction and Administration Matters*, for additional handy information and details regarding the Class and Group Structure for the module. This information has all the relevant information about the module's **Theory Sessions** and **Practical Sessions**, including tutor information, attendance dates and venues. Also refer to the important information contained in the **Module Schedule** document as well as the preceding Sections 3.2 and 3.3.

3.5 Blackboard Access and Use

This module makes substantial use of Blackboard contained within uLink. Students must ensure that they have access from the start of the course. Students are also responsible to access Blackboard on a regular basis as all module-related material (including lecture slides, illustrations, additional material, announcements, assessments, etc.) will be posted on Blackboard on a regular basis.

Students can access the Blackboard environment via the student portal which is accessible via the website link: <http://student.uj.ac.za/>

3.6 Consulting Times

Dedicated consultation times are posted on Blackboard under the **Contacts** section.

	Names	Consulting Times	Email
Lecturer	Mr Sandile Mhlanga	Wednesdays: 12:00 to 14:00 On appointment	smhlanga@uj.ac.za
Tutor 1	Mr Vivaldo Gaston	On appointment	Vivaldo2009@live.com.pt
Tutor 2	Mr Heritier Kaumbu	On appointment	heritierkaumbu@gmail.com
Tutor 3	Mr Zacharias Siphoro	On appointment	zachariasiphoro@gmail.com
Tutor 4	Mr Lunghekani Langa	On appointment	lunghivlanga@gmail.com

Table 7: Lecturer and Tutor Consulting Times

Students are encouraged to adhere to the information made available.

Students are also able to schedule one-on-one or group appointments with the lecturer and tutors using the contact information posted above under Section 1.5. Please ensure

that you include all the details for reference to your query or appointment when making such appointments.

3.7 Assessment Programme for the Semester

Refer to Learning Unit 0, *Introduction and Administration Matters*, for additional handy information and details regarding the schedule of assessments for the module for this semester. Refer especially to the important information contained in the **Module Schedule** document, which may be updated from time to time.

3.8 Composition / Calculation of Final Mark

This subject is an examination subject. You need a semester mark of 40% to write the examination. The semester mark comprises of the two semester tests, class test, assignments, and lab exercises. The final mark will be calculated by semester mark (50%) + examination mark (50%).

Assessments	Weight (%)	Composed	Marks (%)
Class Test	5	Test	5
Lab Exercise	10	Lab Exercise 1	2
		Lab Exercise 2	2
		Lab Exercise 3	2
		Lab Exercise 4	2
		Lab Exercise 5	2
Tutorials	10	Tutorial 1	2
		Tutorial 2	2
		Tutorial 3	2
		Tutorial 4	2
		Tutorial 5	2
Semester Test 1	10	Test	10
Semester Test 2	15	Test	15
Final Assessment	50	Test	50
TOTAL	100		

Table 8: Semester Mark Composition

3.9 Access to the Last Summative Assessment Opportunity

In addition to the final mark as detailed in Section 3.8, the following also apply:

- A minimum pass mark of 50% is required.
- To pass with distinction, a student has to achieve at least 75%.

3.10 Access to Replacement and Supplementary Assessment opportunities

Students have an opportunity to access replacement assessment opportunities for both missed class tests and examinations.

3.10.1 Deferred / Aegrotat / Sick Test Opportunity

There will only be **TWO** deferred (aegrotat or sick) test opportunities for this module. These will be available for those students who produce a valid doctor's certificate after missing a test, together with a completed application form for sitting the deferred test opportunity. The application form is available for download via the module's Blackboard site under Learning Unit 0. It is mandatory that the deferred test opportunity is applied for **within 7 working days** after the test for which you are applying. Any application outside of these stipulations, will not be considered. All deferred test opportunity applications must be lodged via the office of the Academic Coordinator, whose details are in Section 1.4.

In addition to the above, the following may also apply:

- If there is a death of an immediate family member, a student must submit a certified copy of the death certificate accompanied by a sworn affidavit;
- Prior application (with confirmation from the sports bureau or cultural office) for participating in provincial, national or international sports or cultural events;

3.10.2 Supplementary Examination Opportunity

There will a re-assessment opportunity for this module. Students need to arrange to write the supplementary examination with the Faculty Office. It is important to note that the lecturer and the Department do not have any control over the issuing of supplementary examination opportunities.

A supplementary examination opportunity may also be granted by the Faculty Office to those students who obtain a *Final Mark* of between 45% and 49%.

3.11 Collection of Assessment Scripts

All the assessments will be conducted and submitted online via Blackboard, so there will not be any hardcopy material that would constitute an *assessment script* in this module.

3.12 Request / Application for Remarking

Following all the module assessments (assignments and tests), there will be a dedicated set of timeslots during which students can have an opportunity to have their assessments reviewed. This is usually a week following the availability of the results of the assessments, but all necessary information is made available via Blackboard.

3.13 Grievances and Appeals

Students should consult with their lecturer if they experience any problems. Should the matter not be resolved, students must escalate the matter to the Deputy Head of Department responsible for their programme, and this should be done via the Departmental Secretary whose details appear in section 1.3. Students are urged to consult timeously and not when the matter becomes a crisis.

3.14 Dishonesty and Plagiarism

Dishonesty and plagiarism will not be tolerated. The University and the College of Business and Economics view the issue of plagiarism in a serious light. Evidence of plagiarism or dishonesty will be dealt with according to the University's and/or College's Regulations.

The issue of plagiarism as referred to in the Faculty Guidelines for Ethics in Research outlines:

Plagiarism is to:

- present the ideas, words or results of another person as your own, without acknowledging the original author;
- use the ideas or words of another person without giving due credit to that person or source;
- use sentences, paragraphs or parts of articles and books without quotation marks and/or appropriate acknowledgement;
- download sentences, paragraphs or sections of writings from the Internet and to use them without quotation marks and/or proper acknowledgement;
- use another person's direct words without quotation marks, even when you acknowledge the source;
- use ideas without making them properly your own, even though you might have acknowledged the original source;

- formulate your words so closely to those of the original author that it is obvious that you could not have written them without having had the source next to you, i.e. your paraphrasing of the author's words is too close to the original author's use of the words, even if you did acknowledge your source.

Source: Boot, et al. and Schuklenk.

If you use the words and ideas of other people, their words must be clearly indicated in quotation marks and used correctly, and their source indicated to avoid being guilty of plagiarism. No copying of textbooks is allowed.

Plagiarism is wrong because:

- It is theft of intellectual property.
- The person (plagiarist) lies about the contribution made to the project.
- The person (plagiarist) cannot give a true account of how the research was carried out.

Source: Udo Schuklenk (University of the Witwatersrand).

There are benefits to be derived from consciously avoiding plagiarism. By deliberately avoiding plagiarism, students learn:

- the value of doing original work;
- to develop professional skills such as doing research, giving attention to detail and analysing arguments;
- to act with honesty and integrity in their professional lives; and
- to write professionally and engage in debate.

Source: Faculty of Law, the University of the Witwatersrand.

4 Study Components (Learning Units)

4.1 Learning Unit 1 - Big Data, IoT and other 4IR Technologies

4.1.1 Learning Unit Overview

Learning Unit 1, *Big Data, IoT and other 4IR Technologies*, introduces the term: **industrial revolution** and further gives a simple but encompassing definition of what an industrial revolution is. The Learning Unit then looks at a number of tenets (or features) that are

always prevalent in an era of an industrial revolution. These are: **technological**, **socioeconomical** and **cultural** features.

The remainder of the Learning Unit briefly looks at the characteristics of the first, second, third and fourth industrial revolutions as well as the history of these eras. Specific focus is dedicated to the fourth industrial revolution (4IR), especially on how the **physical**, **digital** and **biological** technologies are converging.

Finally, the Learning Unit explores some of the technologies and technological features that are enabling the 4IR (including the Internet of Things (IoT) and Big Data) together with some of the threats and opportunities that are manifesting in the era of the 4IR.

4.1.2 Learning Unit Objectives

The following are the objectives for this Learning Unit:

- Introduce and discuss the 4IR
- Introduce and discuss some technologies enabling the 4IR
- Discuss some of the threats and opportunities in the 4IR

4.1.3 Additional Resources

Type	Description	Reference
Video	What is the Fourth Industrial Revolution? — CNBC Explains	https://tinyurl.com/4IRIntro
Website	UJ's 4IR Information Website	https://tinyurl.com/UJ4IRSite
e-Book*	The 4th Industrial Revolution: Responding to the Impact of Artificial Intelligence on Business	https://tinyurl.com/rurnfe6
e-Book*	The Fourth Industrial Revolution	https://tinyurl.com/t756lll

* e-Books are available through the UJ Library. Make sure that you have your credentials in order to log in.

4.2 Learning Unit 2 - Introduction to Multi-tier Programming

4.2.1 Learning Unit Overview

Learning Unit 2, *Introduction to Multi-tier Programming*, introduces a multi-tier approach to software development. The Learning Unit defines multi-tier architecture as a software architecture in which different software components are organized in tiers (layers), each geared toward providing dedicated functionality.

The Learning Unit then presents the most occurrence of a multi-tier architecture, which comprises of three tiers: the **Presentation Layer**, the **Business Logic Layer**, as well as the **Data Layer**. The presentation layer is responsible for presentation and user

interaction, and comprises the entire user experience. The business logic layer is where most of the processing that the application is responsible for resides. The data layer handles the storage and retrieval of information from data sources such as a database or data files.

The remainder of the Learning Unit looks at some of the advantages and disadvantages of using a tiered architecture approach when developing software. Some of the advantages include: scalability, enhanced security, reusability and interoperability; the disadvantages include performance and sometimes very high investment costs in setting up the infrastructure.

4.2.2 Learning Unit Objectives

The following are the objectives for this Learning Unit:

- Introduce and discuss the concept of multi-tier programming
- Unpack the layers that comprise the popular 3-tier programming architecture
- Discuss some of the advantages and disadvantages of a tiered programming architecture

4.2.3 Additional Resources

Type	Description	Reference
Website	Multi-Tier Architecture	https://tinyurl.com/vwrrpy2o
Website	Three-tier architectures	https://tinyurl.com/uwsaxjn
Website	Overview of a three-tier application	https://tinyurl.com/v2baw8g
Website	3-Tier Architecture: A Complete Overview	https://tinyurl.com/v28mekd
Video	What Is n-Tier Architecture? — Scott Duffy	https://tinyurl.com/rxt6gez
Book	Software Architecture: A Case Based Approach — Vasudeva Varma	Chapter 1, especially the <i>Software Architecture Concepts</i> section.

4.3 Learning Unit 3 - Multi-tier Programming in Practice

4.3.1 Learning Unit Overview

Learning Unit 3, *Multi-tier Programming in Practice*, aims to introduce some of the real-life examples of how multi-tier architectures are implemented in enterprises, building on the introduction to this concept from Learning Unit 2.

The Learning Unit start by looking at a generic setup of a multi-tier application architecture, predominantly applicable to Web-based settings. It then goes into examples of how other organisations, for instance IBM, would typically implement a tiered architecture. The Learning Unit also introduces the concept of **middleware**, which is a

generic term that refers to the software that connects network-based requests generated by a client to the back-end data the client is requesting. This serves as an example of how communication between n-tiers in a multi-tiered architecture environment can talk to each other.

The remainder of the Learning Unit looks at other types of tools that are valuable in a multi-tiered setup at an enterprise level. These include the Service Bus, technologies such as Language Integrated Query (LINQ) as well as database drivers such as the Open Database Connectivity (ODBC).

4.3.2 Learning Unit Objectives

The following are the objectives for this Learning Unit:

- Go through some enterprise examples on adopting a tiered architecture
- Explore some of the technologies that enable a tiered architecture

4.3.3 Additional Resources

Type	Description	Reference
Website	What is an Enterprise Service Bus?	https://tinyurl.com/vcwxpdt
Website	7 Examples of Middleware	https://tinyurl.com/wsmfmnw
Book	Penetration Tester's Open Source Toolkit (Fourth Edition)	Chapter 7 – This chapter deals with <i>Testing Enterprise Applications</i> , which focuses on multi-tiered scenarios
Book	Building Multi-Tier Scenarios for WebSphere Enterprise Applications	http://ibm.com/redbooks

4.4 Learning Unit 4 - Advanced Programming Topics

4.4.1 Learning Unit Overview

Learning Unit 4, *Advanced Programming Topics*, introduces some fundamental programming concepts that make the programming discipline what it is. These include such topics as recursion, data structures, inheritance, sorting and searching algorithms, amongst a few more others.

The aim of the Learning Unit is to ultimately highlight that behind the native algorithms and data structures readily available in C# (for instance the .Sort() method associated with some of the native data structures), there are actual algorithmic implementation at code source level of these fundamental concepts. These concepts define programming to be a powerful tool / skill necessary in the Fourth Industrial Revolution.

4.4.2 Learning Unit Objectives

The following are the objectives for this Learning Unit:

- Introduce some of the fundamental programming topics that make programming powerful
- Focus on implementing one or two of these topics / concepts

4.4.3 Additional Resources

Book	Data Structures and Algorithms Using C#	Michael McMillan, ISBN: 978-0-521-67015-9
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4.5 Learning Unit 5 - Tools and Approaches for Application Development

4.5.1 Learning Unit Overview

Learning Unit 5, *Tools and Approaches for Application Development*, focuses on some of the basic tools and approaches that developers often rely on when developing applications in the C# environment. These include the adoption of Windows Forms, the Windows Presentation Foundation (WPF), as well as Web Services.

Linking back to the concept of a multi-tiered architecture, both the Windows Forms and the WPF provide the developers with novel approaches to developing components for the **Presentation Layer**, with Web Services playing a facilitatory role in the interconnectedness of the various tiers in a multi-tiered development setup (even across geographic boundaries).

The Learning Unit defines these three tools / approaches, including their basic enabling technologies, and briefly outlines how each of these works.

4.5.2 Learning Unit Objectives

The following are the objectives for this Learning Unit:

- Introduce some of the tools and approaches that you can employ when developing applications
- Focus on two of these approaches

4.5.3 Additional Resources

Type	Description	Reference
Website	WPF Tutorial	https://www.wpftutorial.net/
Website	Walkthrough: My first WPF desktop application	https://tinyurl.com/rum3l78

e-Book*	Pro WPF 4.5 in C#	https://tinyurl.com/vxddyxk
e-Book*	Beginning XML with C# 7 - XML Processing and Data Access for C# Developers	https://tinyurl.com/rwy7jl3

** e-Books are available through the UJ Library. Make sure that you have your credentials in order to log in.*

5 Annexures

5.1 Medical Certificate Compliance

Medical certificates need to comply with the following:

The Ethical and Professional Rules of the Medical and Dental Professions Board of the Health Professions Council of South Africa

In terms of the Ethical and Professional Rules of the Medical and Dental Professions Board of the Health Professions Council of South Africa, the medical profession has introduced the following rules with respect to medical certificates:

Rule 15(1): A practitioner shall only grant a certificate of illness if such certificate contains the following information, namely:

- a. the name, address and qualification of the practitioner;
- b. the name of the patient;
- c. the employment number of the patient (if applicable);
- d. the date and time of the examination;
- e. whether the certificate is being issued as a result of personal observations by the practitioner during an examination, or as the result of information received from the patient and which is based on acceptable medical grounds;
- f. a description of the illness, disorder or malady in layman's terminology with the informed consent of the patient: Provided that if the patient is not prepared to give such consent, the medical practitioner or dentist shall merely specify that, in his or her opinion based on an examination of the patient, the patient is unfit to work;
- g. whether the patient is totally indisposed for duty or whether the patient is able to perform less strenuous duties in the work situation;
- h. the exact period of recommended sick leave;
- i. the date of issuing of the certificate of illness; and
- j. a clear indication of the identity of the practitioner who issued the certificate which shall be personally and originally signed by him or her next to his or her initials and surname in printed or block letters.

Rule 15(2): If pre-printed stationery is used, a practitioner shall delete words which are irrelevant.

Rule 15(3): A practitioner shall issue a brief factual report to a patient where such a patient requires information concerning himself or herself.

5.2 Action Words Dictionary

The action words below are often used in required activities, assignments and / or tests / examinations; here you can find out exactly what is expected of you.

Word	Description
Apply	Put to practical use or make use of a relevant equation or law.
Argue	Give reasons or cite evidence in support of an idea, action, or theory, typically with the aim of persuading others to share one's view.
Calculate	Determine the value, using formulae or specific calculation methods.
Classify	Group concepts or subjects together based on certain characteristics or commonalities.
Compare	Point out the similarities and differences between objects or points of view. The word <i>contrast</i> can also be used.
Convert	Transform a quantity expressed in one unit to a quantity expressed in another unit.
Define	Give a short and clear description of a term or concept.
Demonstrate	Show clearly/prove/make clear by reasoning or evidence/illustrate and explain, especially with many examples.
Derive	Deduce or infer something from the given information.
Describe	Tell in detail how a process works or how a subject appears. You need not comment on the process or the subject or give your own point of view.
Differentiate	Find differences between objects or statements.
Discuss	Explain terms or concepts in your own words. Give comments or give your own point of view.
Distinguish	Write down the differences between subjects or concepts.
Draw	Create a drawing, diagram or representation of a subject or concept.
Explain	Write about the subject in your own words. Clarify or give reasons – use examples or illustrations. You must prove that you understand the content.
Formulate	Express in a concise, systematic way.
Identify	Establish the identity or recognise a process.
Illustrate	Explain by means of detailed descriptions and drawings.
Interpret	Explain or clarify the meaning of a concept/value.
List	Briefly write down the facts or main points (see also Name).
Motivate	Give a reason(s) for your answer.
Name	Briefly write down the facts or main points (see also List).
Organise	Arrange data according to certain criteria.
Predict	Use the facts available to derive an outcome.
Relate	Show the relation/connection of entities, how the concepts can be linked.

Solve	Find an answer by using critical thinking and/or calculations.
Summarise	Briefly state/list/write down only the most important detail/facts.
Understand	Show insight into or know the meaning/nature of a concept or term.

Table 9: Action Words Dictionary