

Exercise walk-through

7.1.1

Professional bodies, justifying a software licence, and the impact of AI

A-Level Computer Science

7.1.1 Professional bodies, justifying a software licence, and the impact of AI

Name: _____ Class: _____ Date: _____

Total: 30 marks

KEY WORDS artificial intelligence • code of conduct • copyright • shareware • ethics

Objective

Sheet 7.1 covers acting ethically, copyright, and what the licence types are. This sheet takes the three parts of 7.1 that the parent sheet only names: joining a **professional ethical body**, **justifying** a licence for a given situation across all four families the syllabus lists, and **artificial intelligence** – its applications and its social, economic and environmental impact. This sheet covers syllabus 7.1.

You must be able to:

- show understanding of the need for and purpose of **ethics** as a computing professional,

and the importance of joining a professional ethical body including **BCS** (British Computer Society) and **IEEE** (Institute of Electrical and Electronic Engineers)

- show understanding of the need to act ethically, and the impact of acting ethically or unethically in a given situation
- show understanding of the need for **copyright** legislation
- show understanding of the different types of **software licencing**, and justify the use of a licence for a given situation, including the **Free Software Foundation**, the **Open Source Initiative**, **shareware** and **commercial software**
- show understanding of **Artificial Intelligence** (AI), its applications, and its impact including social, economic and environmental issues

1 Key knowledge and worked examples

Study these first. Each one shows a **method** that a question later on this sheet needs.

■ The professional bodies, and what joining one is actually for

A **computing professional** builds systems that other people have to trust and cannot inspect. Nobody outside the team can tell, by looking, whether a payroll system rounds fairly or whether a medical device logs its failures. **Ethics** is what fills that gap where checking cannot.

The two bodies the syllabus names are the **BCS** (British Computer Society) and the **IEEE** (Institute of Electrical and Electronic Engineers). Learn **four reasons** for joining one:

1. You agree to a published **code of conduct**, so a client knows in advance what standard you hold yourself to.
2. You are **accountable** to the body: it can investigate a complaint and expel a member, which an employer alone cannot do.
3. **Continuing professional development** – the body sets and recognises training, so your competence keeps up with the technology.
4. **Membership is a recognised qualification**, which gives a client or employer evidence of competence without having to test it themselves.

△ In the exam, “act ethically” is never enough on its own. The marks are for the **consequence** in *that* situation – a specific person harmed, a specific trust lost, a specific cost paid.

■ Copyright, and why a licence exists at all

- **Copyright** gives the author of a program the exclusive right to copy it, change it and pass it on. It exists automatically – no registration is needed – and it is what makes the effort of writing software worth paying for.
- A **licence** is the copyright holder writing down which of those rights you are being given. So **every** licence, including the free ones, rests on copyright. “Open source” does not mean “no copyright”; it means the copyright holder has chosen to grant more rights.

■ Four licence families, and how to choose between them

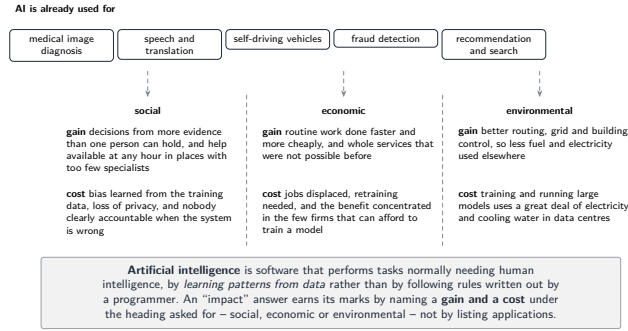
	Copyleft example GPL, FSF and OSI	Permissive example MIT, FSF and OSI	Shareware	Commercial proprietary
run the program	yes	yes	yes, for a trial period	yes
read the source code	yes	yes	no	no
modify it	yes	yes	no	no
pass it on to others	yes, <i>but</i> under this same licence	yes, and you may keep your changes closed	yes, unchanged, to let them trial it too	no
pay for it	may be charged	may be charged	to keep using it after the trial	yes; support by agreement

All four are **copyright** works – the licence is the copyright holder saying what you may do. So the exam question is never "which licence is best" but "which fits *this* situation": ask who needs the **source**, who needs **support**, and who is **paying**.

- **Free Software Foundation (FSF)** promotes the freedoms to run, study, modify and share software. **Free** refers to freedom; the software may be sold.
- **Open Source Initiative (OSI)** approves licences that meet its Open Source Definition. FSF and OSI categories overlap: the **GPL** is both a free-software and an OSI-approved licence.
- **Copyleft**, for example the GPL, requires distributed derivatives to retain the applicable licence and source availability. **Permissive**, for example MIT, permits proprietary derivatives subject to its terms. Compare the licences, not just the organisation names.
- **Shareware** is distributed for trial, with continued/full use subject to its terms, often payment. **Proprietary commercial software** usually restricts source access and modification; check the licence and support agreement. Commercial software can also be open source.

Justify by need: source modification → a free/open-source licence; derivatives must remain available → a suitable copyleft licence; proprietary derivatives allowed → a suitable permissive licence; trial before payment → shareware. Guaranteed support needs a support agreement, not just a licence label.

■ Artificial intelligence, and what an “impact” answer must contain



- **Artificial intelligence** is software that performs tasks normally requiring human intelligence, such as recognising speech or making decisions. An AI system may use programmed knowledge/rules or learn patterns from data; **machine learning** is one approach to AI.
- **Applications:** medical image diagnosis, speech recognition and translation, self-driving vehicles, fraud detection, recommendation and search.
- An impact question names a **heading** – social, economic or environmental – and wants a **gain** and a **cost** under *that* heading. Listing more applications earns nothing.

■ Key knowledge: applying AI to an image

For facial recognition, collect labelled example faces, extract/learn distinguishing features, compare a new camera image with learned/stored features, and classify or match the person. Training data must represent the users; test false matches as well as correct matches. A weight sensor can detect an item leaving a shelf by its change in measured weight; compare with the stored item information. AI is not a synonym for every automatic sensor decision.

Exercise 2.1

2.1 State **two** reasons why a computing professional should join a professional ethical body such as the BCS or the IEEE. [2]

BCS

IEEE

Exercise 2.1

2.1 State **two** reasons why a computing professional should join a professional ethical body such as the BCS or the IEEE. [2]

BCS

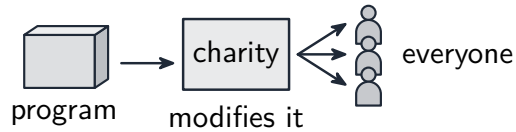
IEEE

2.1 any **two** of:

- you agree to a published **code of conduct**, so clients know the standard you work to
- the body can investigate complaints and expel members, so you are **accountable** to someone outside your employer
- it sets and recognises **continuing professional development**, keeping your competence current
- membership is a **recognised qualification**, which is evidence of competence to a client or employer

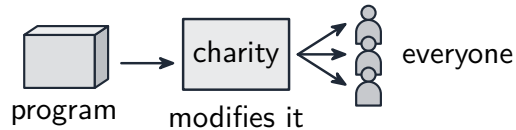
Exercise 2.2

2.2 A charity wants to use and modify an existing program, and is happy for its improvements to be available to everyone else too. Name the licence family it should choose and justify your answer. [3]



Exercise 2.2

2.2 A charity wants to use and modify an existing program, and is happy for its improvements to be available to everyone else too. Name the licence family it should choose and justify your answer. [3]



2.2

- a **Free Software Foundation** licence, such as the **GPL**
- it may run, read and modify the source code freely, which is what “use and modify” needs
- the GPL’s **copyleft** condition requires anything redistributed to carry the same licence, so the charity’s improvements stay available to everyone – which is exactly what it wants
- (A permissive licence also allows modification, but does not require redistributed improvements to remain open; OSI approves both permissive and copyleft licences.)

Exercise 2.3

2.3 Describe what is meant by **shareware**, and state **one** way in which it differs from open-source software. [3]

shareware

open source

Exercise 2.3

2.3 Describe what is meant by **shareware**, and state **one** way in which it differs from open-source software. [3]

shareware

open source

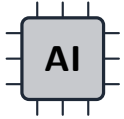
2.3

- shareware is a **closed-source, copyrighted** program given out free of charge so that a user can **try** it before buying
- the trial is limited – by time, or by features disabled, or by a watermark or reminder screen – and payment is needed to keep using it
- unlike open-source software, the **source code is not supplied** and the user may not modify it

Exercise 2.4

2.4 State **two** applications of artificial intelligence.

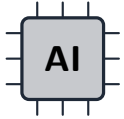
[2]



Exercise 2.4

2.4 State **two** applications of artificial intelligence.

[2]



2.4 any **two** of:

- medical image diagnosis; speech recognition and translation; self-driving vehicles; fraud detection; recommendation or search systems; game playing; handwriting recognition

Exercise 2.5

2.5 Explain **one** environmental impact of the growth of artificial intelligence. [2]



data centre

Exercise 2.5

2.5 Explain **one** environmental impact of the growth of artificial intelligence. [2]



data centre

2.5

- training and running large AI models consumes a **great deal of electricity** in data centres
- much of which is still generated by burning fossil fuels, so carbon emissions rise – and the cooling of those data centres also consumes water
- (a gain is also creditable: better routing, grid and building control can cut fuel use elsewhere)

Exercise 3.1

3.1 A licence allows a user to run a program, read and modify its source code, and pass on a modified version – but requires that any version passed on carries this same licence. Which term best describes this licence? [1]

☐

A commercial

B copyleft, as used by the Free Software Foundation

C shareware

D a permissive open-source licence



program



licence

Exercise 3.1

3.1 A licence allows a user to run a program, read and modify its source code, and pass on a modified version – but requires that any version passed on carries this same licence. Which term best describes this licence? [1]

☐

A commercial

B copyleft, as used by the Free Software Foundation

C shareware

D a permissive open-source licence



program



licence

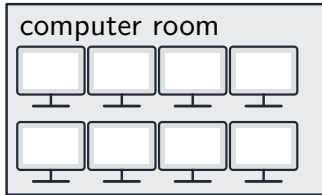
3.1 B

- the right to read, modify and pass on identifies it as a free/open licence, which rules out **A** and **C**
- the requirement that the same licence travels with any redistributed version is **copyleft**, which a permissive licence such as MIT (**D**) does not impose

Exercise 3.2 (a)

3.2 A school is choosing software for its computer room.

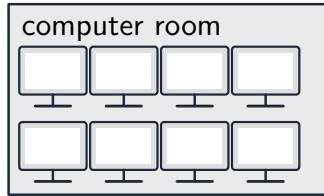
(a) The school needs an office suite with guaranteed technical support and regular security updates, and it has a budget for this. State the most suitable licence type and justify your answer. [3]



Exercise 3.2 (a)

3.2 A school is choosing software for its computer room.

(a) The school needs an office suite with guaranteed technical support and regular security updates, and it has a budget for this. State the most suitable licence type and justify your answer. [3]



(a)

- **commercial** (proprietary) software
- nobody at the school needs to read or change the source code, so the freedoms of an open licence buy it nothing
- the fee pays for **guaranteed technical support and regular updates**, which the school has said it needs and which no one is obliged to provide for a free licence

Exercise 3.2 (b)

3.2 A school is choosing software for its computer room.

(b) A teacher wants to try a video-editing package for two weeks before the department decides whether to buy it. State the most suitable licence type, and state **one** limitation the teacher should expect during the trial. [2]

Exercise 3.2 (b)

3.2 A school is choosing software for its computer room.

(b) A teacher wants to try a video-editing package for two weeks before the department decides whether to buy it. State the most suitable licence type, and state **one** limitation the teacher should expect during the trial. [2]

(b)

- **shareware**
- one limitation: the trial expires after a set period / some features are disabled / exported video carries a watermark / a reminder screen appears

Exercise 3.2 (c)

3.2 A school is choosing software for its computer room.

(c) The computing department wants a programming environment that students can install at home at no cost, and that the technician can change to remove features the class should not use. State the most suitable licence type and justify your answer. [2]

Exercise 3.2 (c)

3.2 A school is choosing software for its computer room.

(c) The computing department wants a programming environment that students can install at home at no cost, and that the technician can change to remove features the class should not use. State the most suitable licence type and justify your answer. [2]

(c)

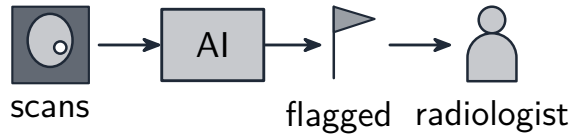
- **open source**, under either an OSI or an FSF licence
- it can be copied and installed at home at no cost, and the **source code is available**, so the technician may modify it to remove the unwanted features

Exercise 3.3 (a)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(a) State what is meant by **artificial intelligence**.

[2]

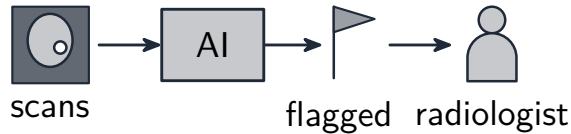


Exercise 3.3 (a)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(a) State what is meant by **artificial intelligence**.

[2]



(a)

- software that performs tasks that would normally require human intelligence
- for example, interpreting a scan and identifying features that may indicate disease; learning from previous scans is one possible implementation

Exercise 3.3 (b)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(b) Describe **one** social benefit and **one** social risk of using this system. [4]

Exercise 3.3 (b)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(b) Describe **one** social benefit and **one** social risk of using this system. [4]

(b)

- **benefit:** the system can compare each scan against far more previous cases than one radiologist could hold in mind
- so tumours are more likely to be caught early, and patients in hospitals with too few specialists can still be screened quickly
- **risk:** the model learns from its training data, so if that data under-represents some group of patients the system will be less accurate for them
- and if a radiologist comes to rely on the flags, a missed tumour may go unchallenged – with no clear answer to who is **accountable**, the hospital, the radiologist or the supplier

Exercise 3.3 (c)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(c) Describe **one** economic impact of introducing this system.

[2]

Exercise 3.3 (c)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(c) Describe **one** economic impact of introducing this system. [2]

(c)

- radiologists' time is used only on the scans that need judgement, so the hospital screens more patients for the same staffing cost
- against which the hospital must pay for the system, its licensing and its maintenance, and fewer junior posts may be needed – so jobs are displaced even where the total cost falls
- (either direction earns the marks, provided the point is genuinely **economic**)

Exercise 3.3 (d)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(d) The AI model was trained in a large data centre. State and explain **one** environmental impact of that training. [2]

Exercise 3.3 (d)

3.3 A hospital introduces an AI system that reads patients' scans and flags the ones that probably show a tumour, for a radiologist to check.

(d) The AI model was trained in a large data centre. State and explain **one** environmental impact of that training. [2]

(d)

- training a large model runs many processors continuously for a long time, consuming a very large amount of **electricity**
- which produces carbon emissions wherever that electricity is generated from fossil fuels, and the data centre additionally consumes water for cooling