# PRINCIPLES FOR EFFECTIVE DEGREE ALGORITHM DESIGN

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## Higher education in the UK benefits from being composed of a diverse and autonomous sector in which innovation, specialisation and creativity can flourish, underpinned by a strong commitment to academic standards.

It is through this that the UK has developed its world-leading reputation for high-quality teaching and learning across a wide range of subjects, offering students choice and flexibility in what and how they study. This is crucial in ensuring that graduates collectively bring the full array of skills and knowledge that our society and economy needs, while individually pursuing their own academic interests, and that a university education is accessible to all types of student and learner.

The **statement of intent** published by the **UK Standing Committee for Quality Assessment** (UKSCQA, 2019) states that the system as a whole benefits from common principles and arrangements to protect the value of the degrees providers offer and award. This makes sure that students can understand how their achievement compares with that of others, and can be confident that their classification is an accurate and fair reflection of their performance, and so take pride in their qualifications.

Degree algorithms are the method of calculation through which a final classification is awarded to a student when they graduate. The classification offers a summary of how well the student has performed. For undergraduate honours courses, once all of a student's work has been assessed, marked and moderated, the algorithm process determines whether they receive a first, upper-second, lower-second, third classification, or a pass.

There is variation across the sector in how algorithms are designed; this typically reflects differences in teaching and assessment and the skills on which graduates have been tested within their specific degree programme. However, to provide assurance that this does not undermine the sector's commitment to protecting the value of qualifications at the point of award and over time, providers have established the following principles for effective algorithm design for undergraduate degree classification.

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**To be effective, an algorithm must:**

1. provide an appropriate and reliable summary of a student's performance against the learning outcomes, reflecting the design, delivery and structure of a degree programme.

2. fairly reflect a student's performance without unduly over-emphasising particular aspects, with consideration being taken at the design stage of how each element within a method of classification interacts with other elements.

3. protect academic standards by adhering to the current conventions and national reference points used to define classification bands and boundaries.

4. normally be reviewed at least every five years – or alongside national cyclical review timetables – to ensure algorithms remain relevant and appropriate, with input from across the provider, including students, academic and non-academic staff, and accrediting bodies.

5. be designed and reviewed in a way that is mindful of the impact of different calculation approaches to classification for different groups of students.

6. be communicated and explained clearly to students, both in how it works and why.

## PRINCIPLE 1: An algorithm must provide an appropriate and reliable summary of a student's performance against the learning outcomes, reflecting the design, delivery and structure of a degree programme

The diversity of the UK higher education system is one of its strengths. No one degree programme is the same as another. In some programmes accredited by professional, statutory and regulatory bodies (PSRBs), there may be core modules that follow a more aligned structure across the sector or a set curriculum, while programme approval for any degree must be matched to the Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies, published by the Quality Assurance Agency (QAA, 2014).[1] Across and within disciplines more broadly, however, providers and their academic departments retain autonomy over how a programme is designed and delivered, the learning outcomes students will be working towards, the modules on offer and their credit weighting, and, within these, the types of assessment and content covered. This variation is important for student choice. Students will have different interests within subject areas and different learning styles, albeit they should have the opportunity to benefit from academic specialisms across the research community.

The algorithm for any degree programme must reflect learning outcomes. Students and employers must be confident that the classification is a reliable indicator of performance. It must also be sensitive to the structure of the degree. This might mean making specific adjustments to account for practical and placement-based learning, integrated Master's courses, or FHEQ level 6 entry (SCQF level 8/9),[2] for example. Within these rationales, however, some consistency in approach remains crucial to ensure fairness and transparency for students across similar programmes.

## PRINCIPLE 2: An algorithm must fairly reflect a student's performance without unduly over-emphasising particular aspects, with consideration at the design stage of how each element within a method of classification interacts with other elements

Any algorithm comprises multiple elements. Whether it uses a modal approach or, more commonly, an arithmetic mean, it will require decisions on things such as: weighting, discounting and credit requirements; rounding and borderline adjustment; and re-sits and re-assessment. The same objective – for example, an emphasis on level 6 (SCQF level 10) learning – could be achieved in different ways. For example, it could be achieved through (a) weighting more heavily towards the final year of study; (b) discounting some credits at lower levels; or (c) adopting a second borderline algorithm that considers performance in the final year, for instance the mark received for a dissertation or the number of credits awarded within each classification boundary. The challenge for providers can emerge where all three approaches are taken to achieve the same objective, thereby creating an accumulative and potentially inflationary algorithm.

Providers must act responsibly to ensure that when taken as a whole, the final algorithm continues to reflect the stated principles, assuring themselves that the chosen elements neither interact so as to cancel each other out, nor unduly reinforce each other.

## PRINCIPLE 3: An algorithm must protect academic standards by adhering to current conventions and national reference points used to define classification bands and boundaries

The consideration of classifications that fall at the boundary of a particular classification plays an important role in ensuring that achievement is properly recognised. However, there is a risk that confidence in standards will be undermined if rule-based or discretionary approaches, or general rounding policies, have the effect of lowering a classification boundary. Investment in work at the level of assessment marking, such as training and calibration activities for academic staff, should be a primary mechanism for ensuring fair and comparable awards for students' achievements.

The QAA, working with UUK and GuildHE on behalf of the UKSCQA, published a set of common **degree classification descriptions** in October 2019 that set out the agreed general criteria that students across the UK should meet in order to achieve the different classes of qualification at bachelor's honours degree level. These descriptions have been appended to the Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies (QAA, 2019). They list the expected level of achievement within each classification. It is important that the classification determined by an algorithm closely matches these expectations to ensure some sector-wide comparability. Typically, although not always, the following classification boundaries are used: first ($\geq$70), upper-second (60–69), lower-second (50–59), third (40–49), pass (35–40). Alternative scales, for example between 1 and 20, are also used by some degree-awarding bodies. Whatever marking scale is used, the final classification nevertheless must align with sector reference points.

## PRINCIPLE 4: An algorithm must normally be reviewed at least every five years – or alongside national cyclical review timetables – to ensure algorithms remain relevant and appropriate, with input from across the provider, including students, academic and non-academic staff, and accrediting bodies

Institutions should normally review their degree algorithms at least every five years, but can do so at more regular intervals if and when there is a perceived need, for example in the case of a merger, a new partnership arrangement, securing degree-awarding powers, or a wider review of academic regulations. It might also be prompted by an unexpected pattern in degree outcomes or widely held and sustained external examiner concerns. Reviews are crucial to ensuring that degree algorithm(s) remain relevant and appropriate, and that the value and comparability of awards over time are protected. It is important that there is regular consideration of how effectively the algorithm is working across an institution's provision.

It is essential that students have confidence in the academic arrangements of the institution and it is to be expected that students, as members of the wider academic community, are engaged in any review and re-assessment of academic regulations, alongside academic staff, PSRB representatives and non-academic staff across registry, quality and planning departments. This ensures that any review considers learning outcomes and programme design, the impact on classification across student groups, the relationship to other internal and external regulations, and the practical requirements for implementation of any changes.

## PRINCIPLE 5: An algorithm must be designed and reviewed in a way that is mindful of the impact of different calculation approaches to classification for different groups of students

Any change to academic regulations, including those relating to degree algorithms, must consider and model the potential impact on classification for different groups of students. Providers should avoid making changes or implementing policies too quickly that may inadvertently create or exacerbate attainment gaps or differential outcomes before understanding the root causes and ensuring mitigating actions are taken. An algorithm itself should not be a primary means of reducing an attainment gap, nor maintained simply to avoid an attainment gap emerging. However, if groups of students are consequently expected to be disadvantaged at classification stage compared with others, it might highlight issues within the curriculum, programme design and learning environment that are affecting the distribution of marks going into the algorithm. This should then be the focus for institutions: the algorithm is applied not to students, but to students' marks.

## PRINCIPLE 6: An algorithm must be communicated and explained clearly to students, both in how it works and why

It is important for the sake of transparency that students understand how their classification will be determined, why a particular approach to classification has been adopted, and how this corresponds to the structure of the degree and learning outcomes. Algorithms themselves can affect student choice and behaviour, for example in the optional modules they choose, and in how they study and approach assessment. A lack of clarity about how marks will be used to classify a degree and why an approach is considered most appropriate undermines transparency and risks students being unaware of what they need to do to achieve their learning outcomes. This information should be provided at a basic level within programme handbooks and discussions of assessment, with reference made to academic regulations for more technical guidance. Where there are PSRB requirements, these should also be clearly communicated.

## IMPLEMENTING THE PRINCIPLES: MODELS OF PRACTICE

The following section describes how these six principles might be implemented across the different decisions that will be taken in the review and (re-)design of an institution's algorithm(s). When making these decisions, institutions must ensure that the model of practice adopted remains appropriate for the provision to which it applies. They must be able to explain clearly why an approach is used or a change is being made, and how this applies to academic standards and protects the value of qualifications.

It is also important to note that in exceptional circumstances, an algorithm may need to be temporarily adjusted for particular cohorts to reflect changes in teaching, learning and assessment that are necessary as a result of external and unforeseen circumstances.

### Weighting

In England, Wales and Northern Ireland, honours degrees are typically of three years' duration, whereas in Scotland they are normally four years in length. Across UK higher education, the weighting attached to a degree algorithm is typically based on one of four rationales (indicative weightings are given for three-and four-year degrees).

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1. **Exit velocity (0/0/100 or 0/0/0/100):** This weighting is typically used where it is important for the classification to reflect solely the student's achievement at the end of their studies. It may be chosen in courses where particular importance is placed on a final performance, project or portfolio, and/or where classification is designed to reflect a level 6/10 qualification achieved across a linear curriculum.

2. **Emphasis on exit velocity (0/33/67 or 0/0/25/75):**[3] This weighting is typically chosen to give additional importance to the final year and/or highest level of study, while also using credits from the penultimate level to account for core learning undertaken earlier in the degree programme and to reduce pressure on the final year of study.

3. **Equal weighting (0/50/50 or 0/0/50/50):** An 'equal' or 'even' weighting is typically used where consistency in performance across the final and penultimate level is required, where both levels are viewed as equally important for core learning outcomes and the final classification.

4. **Level 4/8 inclusion (10/30/60 or 0/10/30/60):** A weighting that includes marks from level 4/8 may be used to encourage early engagement in a student's studies and where a more modular structure is adopted.

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The above models and associated weightings illustrate the most typical approaches to algorithm design.[4] Where possible, variation within these should be kept to a minimum, to ensure some sector-wide comparability and stability of outcomes, while also making sure there is simplicity and transparency for students in how their award will be classified. Alternative arrangements may be in place for integrated master's degrees that take place typically over four years in England, Wales and Northern Ireland and five years in Scotland, where these are classified.

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3. Weighting proportion adjusted to reflect the number of levels within three-and four-year degrees.
4. For more information on algorithm models, see *'Degree algorithm practice in 2020: research report'*, (UUK, 2020)

## Discounting

Academic experimentation and risk-taking by students are important elements of course design. They support students to explore a range of academic interests before specialising, and make it possible for them to bring a range of contextual knowledge and understanding to their degree, with the freedom of knowing that while they may still need to pass modules (and therefore achieve the credit) and meet the learning outcomes to progress, a lower mark will not necessarily affect their overall classification. Discounting early on, for example for the first year of study,[5] can also be important in supporting students, particularly those from disadvantaged backgrounds, to adjust to university life and develop the academic skills required at levels 5 and 6 (levels 9 and 10 in Scotland). It can also be important in programmes where taking a wider range of subjects is encouraged early on, before specialising later.

However, it is important that any form of discounting is minimised to reduce its inflationary potential and ensure the title of the degree awarded is not misleading.

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**Suggested and common approaches across the sector include:**

- **no discounting at level 6/10 (typically the final year of study)**,[6] to reflect the higher level of learning required for a bachelor's with honours degree – it is also expected that students, by this point, will have moved from subject experimentation to subject specialisation, where all modules are equally relevant.[7]

- **no discounting of core and compulsory modules**, which are key indicators of a student's performance on the required learning outcomes– this is particularly important for PSRB-accredited courses, where the content and skills that are assessed are specified.

- **discounting being kept to a minimum number of credits**, to ensure that the majority of the students' performance is included in the algorithm and so contributes to their classification.

- **clear instruction on how any discounting applies** to (a) progression; (b) the final award; and (c) the final classification, to ensure students are clear about how it will be applied to their degree.

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Discounting should not be applied as a proxy for mitigating circumstances policies. Students requiring an adjustment due to legitimate personal circumstances, for example, will be supported by institutions primarily at the assessment and examination board stage before the algorithm is applied. This will reflect the student's individual circumstances and the parts of their learning that were affected. Similarly, while being sensitive to the reality that sometimes an individual will have an uncharacteristically poor performance, to ensure fairness and transparency, discounting should not be used to address this. Increasingly, modules are being designed to include multiple forms of assessment arranged at different points in the term, semester or exam period, which minimises the impact of an isolated poor performance.

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5. In this case, students will still need to accumulate the requisite credits to progress and receive their degree award, and their marks will feature on their academic transcript.

6. Level 6 in England, Wales and Northern Ireland and level 10 in Scotland (see QAA, 2014 for more details).

7. That is, in line with the *Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies* (QAA, 2014).

## Classification at the borderline

Borderline policies have the potential to re-write grade boundaries, and so changing the existing conventions upon which sector-recognised standards are based. While a rule-based approach to any re-consideration of a student's final classification should be encouraged to avoid the potential for a discretionary approach, this can also have the effect of becoming a de facto second algorithm. This is in tension with the need of the original algorithm to fully reflect learning outcomes and suggests there may be something the original algorithm is failing to consider.

A classification algorithm that uses an arithmetic mean – the most common approach across the sector – faces the challenge of trying to summarise multiple marks with a single number and can be skewed by an unusually high mark or unusually poor mark. There is also subjectivity in academic judgement, which can result in minor discrepancies in marking practices. These are typically accounted for through moderation processes, second markers and external examination, but have historically also been addressed through algorithm design. The focus for institutions should be directed towards improving assessment, marking and moderation.

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**Recommended practice for algorithms includes:**

- **a maximum zone of consideration of two percentage points from the grade boundary**, with no additional rounding. For example, in a percentage-based classification scale, re-consideration of a mark of 68 for a first but no consideration of a mark of 67.99. This ensures there is no further lowering of a grade boundary and that it is clear to students what the zone is.

- **any adjustment of a classification should be rule based and anonymous**, to avoid the potential impact of unfair discretion. Where rules are applied, these should be developed with clear consideration of the original algorithm and not replicate – and thereby over-emphasise – the aspects already accounted for. For example, if the weighting of the algorithm already emphasises exit velocity by more heavily weighting level 6/10, re-consideration on the basis of level 6/10 performance risks 'double counting', and should be avoided.

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## Rounding up

Rounding up a student's final mark – the mark that determines their classification – within 0.5% is viewed across the sector to be fair, arithmetically appropriate, and easy for students to understand. Currently, however, there is the opportunity for marks to be rounded twice in the calculation of a degree classification: first within a module mark where a module comprises multiple assessment components, and again within the final classification. The additive effect of this may produce a mark that does not reflect learner achievement.

For classification, rounding should ideally only occur for the final mark. This should not necessarily prevent students from receiving individual marks for assessment, nor a rounded mark for a module, which can feature on a transcript and be an indication of the level of their performance, However, it should be clearly explained to students in these cases that their classification will be calculated on the basis of raw and not the rounded marks.

## Multiple algorithms for individual students

It is recommended that where possible, an individual student's attainment should be classified using only one algorithm, and this should be stated clearly to students at the start of their programme. The algorithm should ideally be designed against clear learning outcomes for the programme in question, rather than adapted to meet the needs of different student achievement profiles. Where there are differences between students, these should be addressed through curriculum design and the teaching and assessment methods used. Adopting a single algorithm for every student on the same degree programme ensures greater transparency and comparability within a cohort.

If an institution implements a change to the algorithm while a student is studying, there may be exceptional grounds for applying two algorithms. In line with consumer protection legislation and the regulatory expectations of the Competition and Markets Authority, it is important that there is some consistency in academic regulations over the course of a student's programme. Algorithms can affect students' choices and behaviours; a student should not be unfairly disadvantaged, for example, for having taken a risk in their choice of electives if a component that was originally discounted is reinstated within the algorithm calculation. However, nor should they be disadvantaged if the new and more appropriate algorithm would yield a different classification.

## APPLYING FOR DEGREE-AWARDING POWERS

When applying for degree-awarding powers (DAPs), providers should be mindful of the principles outlined here. A provider's proposal as to how it will classify its academic awards should ensure that the design of the degree algorithm is transparent and that there is evidence to show that it will ensure fair assessment of student outcomes and aid the maintenance of robust academic standards. Applicant providers will be expected to demonstrate that the algorithm is appropriate to the provision, assessment practices and cohorts, and mindful that their decisions around degree algorithms may affect how they meet DAP criteria relating to academic governance, regulatory frameworks, academic regulations, assuring academic standards, assessment and external examining.

In particular, applicant providers will be expected to produce evidence showing how their comprehensive academic frameworks (and/or regulations) govern the award of academic credit and qualifications, as assessors will be interested to see how external reference points and available guidance, such as this publication, have been taken into account by providers when designing their approach.

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