

Academic Reading Paper 40

Shrines, Dinosaurs and Averages

Time allowed: 1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until you are told to do so.
- Write your name and the date at the top of the answer sheet.
- Answer **all** the questions.
- Write your answers **on the answer sheet**, not in this booklet.
- You must transfer your answers within the hour. **No extra time is given for transferring answers in the Reading test.**
- Do not remove this booklet from the examination room.

INFORMATION FOR CANDIDATES

- There are 40 questions in this paper.
- Each question carries one mark.
- There are three passages, with 13, 13 and 14 questions.

These passages were written for this library. They are **not** reproduced from any published past paper. The format, timing and task types follow the published specification for the Academic Reading test so that sitting this on paper feels like the real thing.

You should spend about 20 minutes on **Questions 1–13**, which are based on Reading Passage 1 below.

Rebuilt so that it can be rebuilt

At Ise in Japan there are two adjacent plots of the same size, and at any moment one of them holds a shrine and the other holds nothing but raked gravel. Every twenty years the buildings are constructed afresh on the empty plot, the deity is moved across, and the old buildings are taken down, leaving that side bare until the next cycle. The practice is said to have begun around the year 690, and the most recent rebuilding, the sixty-second, was completed in 2013. The two plots are therefore used alternately, so that a site which is empty now held the shrine twenty years ago and will hold it again twenty years hence.

What is rebuilt is not only the main sanctuaries. The work covers the surrounding halls, the fences, the bridges and something in the order of sixteen hundred ritual objects, all remade to the same specification by the same methods. Around ten thousand cypress logs are required. The preparation begins about eight years before the buildings go up and proceeds through a long sequence of ceremonies, starting with the felling of the first trees and including the movement of the timber and the setting of the central post. Each of these stages has its own date, its own participants and its own form of words, and the schedule is fixed long in advance rather than adjusted to the progress of the work.

To a European conservator this is difficult to classify. A building at Ise is never old. No piece of the structure standing today has been there for more than twenty years, and the question of whether it is the same shrine that stood in the eighth century has an obvious answer in terms of material and a different obvious answer in terms of everything else. The dispute this provokes is usually conducted as though it were about authenticity, and it is more useful to ask what the arrangement is for.

The answer is in the interval. Twenty years is roughly the length of a working generation in a craft. A carpenter who worked on one rebuilding as an apprentice will be experienced at the next and will be teaching at the one after that, and the knowledge required, which is joinery of a kind that uses no nails and depends on the fit of one piece of wood into another, does not survive in drawings. It survives in hands that have done it. A drawing can record where a joint goes; it cannot record how hard to drive it, or how the timber behaves as the weather changes, and those are the parts that take years to acquire. A cycle of fifty years would break the chain, because the people who had done it last time would be gone.

So the building is not the thing being preserved. The building is the medium. What the cycle maintains is a body of skill that decays if it is not exercised, and the shrine is rebuilt in order that there should continue to be people who know how to rebuild it. On that reading the bare gravel plot is not an absence but a part of the design.

The timber is not wasted, which matters given the quantity. The dismantled buildings are taken apart and the wood distributed to shrines throughout the country, where it is used in their own repairs and constructions. Cypress of that age and quality is scarce enough that a shrine in a small town may wait

decades for its share. The great timbers of the bridge are re-erected as gateways at the entrances. A rebuilding at Ise therefore supplies material to hundreds of other places, and the wood ends its life gradually and elsewhere rather than all at once.

There is a supply problem underneath all of this and it has been addressed on a timescale that is hard to hold in the mind. The forest immediately around the shrine was worked out centuries ago, and the timber has long been brought from further away. In 1923 a programme of replanting was begun with the intention that the shrine should eventually draw again on its own forest. The trees required are expected to be ready in the 2120s. The programme is a two-century undertaking, already a century into its course, whose planners knew they would not see it.

The continuity is not quite unbroken, and the honest version says so. During the civil wars of the fifteenth and sixteenth centuries the rebuilding lapsed for something like a hundred and twenty years, and the practice had to be restarted. That gap is longer than the working life of any carpenter, which means that at least once the chain of hands was broken and something had to be reconstructed from records and from surviving buildings elsewhere. A tradition that has been repaired is still a tradition, and pretending otherwise would make the achievement smaller than it is.

Questions 1–5

Complete the notes below.

Choose **NO MORE THAN TWO WORDS AND/OR A NUMBER** from the passage for each answer.

The rebuilding at Ise

Materials and preparation

- Two plots of equal size are used in turn; one always stands empty.
- About ten thousand logs of **1** are required for the work.
- The sequence of ceremonies opens with the **2** of the earliest trees.
- Preparation begins about **3** in advance of construction.

Method and re-use

- The joints are made without the use of any **4**
- The large timbers of the **5** are re-erected as gateways.

Questions 6–9

Complete the sentences below.

Choose **NO MORE THAN TWO WORDS AND/OR A NUMBER** from the passage for each answer.

- 6** An interval of twenty years is close to the length of a working in the craft.

- 7 The knowledge the work depends on cannot be held in , only in practice.
- 8 Planting was begun in 1923 so that the shrine could once again draw on its own •
- 9 The rebuilding stopped for about 120 years during a period of

Questions 10–13

Do the following statements agree with the information given in Reading Passage 1?

Write **TRUE** if the statement agrees with the information, **FALSE** if the statement contradicts the information, or **NOT GIVEN** if there is no information on this.

- 10 No part of the shrine now standing has been in place for longer than twenty years.
- 11 The replanting scheme was started before the woodland nearest the shrine was exhausted.
- 12 The replanting scheme has cost more than was expected when it began.
- 13 Knowledge of the building method was passed on unbroken through the fifteenth and sixteenth centuries.

You should spend about 20 minutes on **Questions 14–26**, which are based on Reading Passage 2 below.

The bone that was not there

- A** Thomas Henry Huxley noticed the resemblance in the 1860s. Comparing the hind limb of a small dinosaur with that of a bird, he found the correspondence so close that he proposed birds were the descendants of dinosaurs, and he said so in print. He had the specimens, he had the argument, and for about sixty years afterwards almost nobody agreed with him. The idea was not ignored so much as answered, and the answer held. Understanding why is more instructive than the eventual vindication, because the objection that defeated him was specific, reasonable and wrong in a way that is easy to miss.
- B** In 1926 Gerhard Heilmann published a book that settled the question for a generation. He accepted almost everything about the similarity and then produced what appeared to be a decisive obstacle. Birds have a wishbone, formed from two collarbones fused together. Dinosaurs, on the evidence then available, did not have collarbones at all. A structure cannot reappear once it has been lost, so a group that has no collarbones cannot give rise to a group that has them fused, and the resemblance must therefore be a case of two lineages arriving separately at a similar solution. Heilmann proposed instead that both had descended from an earlier and more generalised group of reptiles, which accounted for the shared features without requiring the lost bone to return.
- C** The reasoning is sound and the premise was false. Dinosaur collarbones are thin, they are not attached firmly to the rest of the skeleton, and they are therefore among the first bones to be lost when a carcass is disturbed or a fossil is prepared. They had in fact been reported before Heilmann wrote, in at least one specimen, and the report had not been taken up. For fifty years afterwards preparators worked on dinosaur skeletons without particularly looking for a bone that the standard authority said did not exist, and the absence became better established every year by not being examined. This is a failure with no villain in it: each individual worker was following the best available summary of the field, and the effect of all of them doing so was that the summary went unchallenged.
- D** The question reopened because of an animal found in Montana. John Ostrom described *Deinonychus* in 1969, and it did not fit the picture of dinosaurs that then prevailed. It was built for speed and agility rather than for bulk, it carried a large sickle claw on each foot, and the details of its wrist allowed a folding motion of the hand that is otherwise known in birds. Ostrom then went back to the specimens of *Archaeopteryx*, the earliest known bird, and found that one of them had been sitting misidentified in a museum as a small dinosaur, which is a comment on how similar the two are. The specimen had been catalogued years earlier by people who were competent and unhurried, and the mistake was possible because the skeletons genuinely are hard to tell apart once the feather impressions are overlooked.

- E** What settled it arrived in the 1990s from a lake bed in north-eastern China. The sediments at Liaoning are fine enough to preserve soft tissue, and from 1996 they produced dinosaurs with feathers: first simple filaments, then branched structures, then in some species fully formed vaned feathers of the kind used for flight, on animals that plainly could not fly. Feathers had evolved before flight and for some other purpose, and they had evolved in dinosaurs. Insulation and display are the usual candidates, and neither requires the animal to leave the ground. Within a decade the number of feathered species from the site was large enough that the argument shifted from whether some dinosaurs had feathers to how widely the covering was distributed across the group.
- F** The collarbones, meanwhile, turned up. Once people were looking for them they were found in one group after another, including in the animals most closely related to birds, and the obstacle that had held the field for sixty years dissolved into a fact about how skeletons come apart. Nothing had been suppressed and nobody had behaved badly. A negative claim had been made from the material available, and negative claims of that kind are only as good as the effort spent looking.
- G** One correction is worth making to the popular version, which holds that the dinosaurs never died out because birds are dinosaurs. In the technical sense used by biologists this is exactly right: birds sit inside the dinosaur group as a branch of it, and a branch does not leave the tree it grew on. In the ordinary sense it is misleading, because an extinction at the end of the Cretaceous did remove every dinosaur lineage except one, and describing that as survival tells a reader something false about what happened.

Questions 14–18

Reading Passage 2 has seven paragraphs, A–G.

Which paragraph contains the following information?

Write the correct letter, A–G.

NB You may use any letter more than once.

List of Paragraphs

- A** Paragraph A
- B** Paragraph B
- C** Paragraph C
- D** Paragraph D
- E** Paragraph E
- F** Paragraph F
- G** Paragraph G

- 14** a specimen that had been placed in the wrong group
- 15** an explanation of why a particular bone is seldom preserved
- 16** a different line of descent put forward to account for shared features

- 17** a comment on how much weight a claim of absence should be given
- 18** a statement that is correct in one sense and misleading in another

Questions 19–22

Look at the following statements and the list of people below.

Match each statement with the correct person, A–C.

NB You may use any letter more than once.

List of People

- A** Thomas Henry Huxley
- B** Gerhard Heilmann
- C** John Ostrom

- 19** was the first to publish the claim that birds descend from dinosaurs
- 20** described an animal whose hand could fold in a way otherwise seen in birds
- 21** held that a structure once lost could not appear again
- 22** went back to specimens of the earliest known bird held in museums

Questions 23–26

Complete the summary using the list of words, A–H, below.

List of Words

- A** flight
- B** soft tissue
- C** purpose
- D** searching
- E** extinction
- F** climate
- G** speed
- H** drawings

How the question was closed

The sediments at Liaoning are fine enough to preserve **23**, and from 1996 they produced dinosaurs carrying filaments and, in some species, fully formed vaned feathers on animals

that could not manage **24** The covering must therefore have served some other
25 first. The missing collarbones were then found in group after group once
people started **26** for them.

You should spend about 20 minutes on **Questions 27–40**, which are based on Reading Passage 3 below.

What an average hides

In the late 1940s the United States Air Force had a problem it could not explain. Accident rates were high, and not in the way that inexperience produces. Pilots were reporting that they could not reach the controls comfortably, that the seat was wrong, that the stick was at the wrong distance. The cockpits had been designed to fit the average pilot, using measurements taken in the 1920s, and the obvious hypothesis was that the average had shifted since then. So they measured again, taking ten dimensions from more than four thousand pilots, among them height, chest circumference, arm length and the distance from the shoulder to the wrist.

A young researcher then asked a question nobody had put. Rather than recomputing the average, he took the middle thirty per cent of the range on each of the ten dimensions and counted how many of the four thousand pilots fell inside that band on all ten at once. The answer was none. Not a small number: none. Nobody in the sample was average in the way the cockpit had been designed for, because being close to the middle on ten independent measurements at the same time is an event that essentially does not occur. Even reducing the test to three of the ten dimensions left only a few dozen pilots qualifying out of the four thousand.

The response was the interesting part. The Air Force did not recompute a better average. It required manufacturers to build adjustable seats, adjustable pedals, adjustable straps and helmets in a range of sizes, over the objections of firms who said it was impossible and expensive. It was neither, it is now in every car you have sat in, and the accident rates fell.

The general point is not that averages are useless, which is the overcorrection people reach for. An average is an excellent summary of a distribution with one peak and no long tail, and a great many quantities are like that: the height of adult men in one country, the time it takes to boil a litre of water, the weight of a batch of manufactured components. For these the average is not a convenient approximation to something more complicated; it is the honest centre of the data, and most values sit near it. Where the distribution has that shape, the average tells you what to expect and the spread tells you how confident to be, and nothing is hidden.

The trouble is that a large proportion of the quantities that get averaged are not like that at all. Incomes have a long tail to the right, so the average sits above what most people earn and moves whenever a small number of very large values change. Delays, damage from storms, the size of cities, the number of connections a person has and the length of a hospital stay all have the same shape. For these an average is not merely imprecise; it is a number that describes almost nobody and moves for reasons unconnected to the bulk of the population.

The specific error the Air Force made is worth separating from the statistical one, because it is a design error and it is everywhere. Designing for the average person produces something that fits nobody, and it does so more severely the more dimensions the design has to satisfy. A chair fitted to average height and average leg length and average weight and average reach is fitted to a person who does not exist. The correct response is a range, and the cost of providing one is almost always lower than the cost of the misfit.

The concession is real and should be stated. Individual attention does not scale, and a designer, a policy-maker or a doctor cannot treat every case as unique. There are decisions that must be made for populations, and refusing to summarise is not a form of rigour; it is a refusal to decide. Somebody who responds to every average with the observation that individuals vary has not made a contribution. The objection is always available and it is almost always cost-free, which is a reliable sign that it is doing no work.

What is being asked for is narrower. Report the spread alongside the centre, as a matter of routine, so that a reader can see whether the average is describing anything. Say which shape the distribution has, since the word average means something quite different for symmetrical data than for a long tail. And when a thing is being designed rather than described, treat the range as the specification and the middle as one point within it, which is what the Air Force worked out in 1950 and much of the world has yet to apply.

Questions 27–32

Do the following statements agree with the claims of the writer in Reading Passage 3?

Write **YES** if the statement agrees with the claims of the writer, **NO** if the statement contradicts the claims of the writer, or **NOT GIVEN** if it is impossible to say what the writer thinks about this.

- 27** The writer believes averages should be kept out of most reporting.
- 28** The writer thinks the objection that individuals differ is made too readily.
- 29** The writer considers the measurements taken in the 1920s to have been carelessly made.
- 30** The writer agrees with the manufacturers that adjustable fittings would be expensive.
- 31** The writer holds that designing for a middle value becomes worse as the number of requirements grows.
- 32** The writer thinks statistics should form part of a designer's training.

Questions 33–36

Complete each sentence with the correct ending, A–G, below.

List of Endings

- A a few very large values pull the figure upward.
- B suit nobody in particular.
- C the data has a single peak and no long tail.
- D give the spread as well as the centre.
- E cost more than a design of fixed size would.
- F be preferred by the firms that build it.
- G only one dimension is being measured.

- 33 An average describes a set of figures well when
- 34 Income is a poor case for averaging because
- 35 A chair built to several average measurements at once will
- 36 The writer asks that people who report figures should

Questions 37–40

Choose the correct letter, A, B, C or D.

- 37 What did the young researcher's calculation show?
- A No pilot fell inside the middle band on all ten dimensions.
 - B The average pilot had grown since the 1920s.
 - C Ten dimensions were too few to describe a pilot.
 - D Most pilots were close to average on at least one dimension.
- 38 What does the writer say the Air Force did in response?
- A It calculated a more accurate average.
 - B It replaced a single fixed size with adjustment.
 - C It reduced the number of dimensions it measured.
 - D It was obliged to give way to the manufacturers.
- 39 Why does the writer mention hospital stays and the size of cities?
- A to show how widely averages are used in public life
 - B as further quantities with a long tail
 - C to argue that large data sets are unreliable
 - D to contrast public with private measurement

- 40** What is the writer's main conclusion?
- A** Individual assessment should replace the use of averages.
 - B** A design should treat the range as its specification.
 - C** Statistical summaries mislead more often than they help.
 - D** The cost of variation should fall on manufacturers.