Undergraduate Admissions Assessment March 2019
TEST 1 - (Sections A, B1 and D). Three Hour Assessment.

The UG Admissions Assessment (UGAA) gives Admissions Tutors the opportunity to see a sample of the applicant's original work, produced under examination conditions, and seeks to assess applicants from a variety of backgrounds in a fair and equitable manner.

The assessment has three sections: comprehension exercises (**Section A**); essay questions (**Section B**); and mathematical problems (**Section C** *or* **D**). The purpose is to assess the applicant's English language and mathematics abilities. *It is not an assessment of general knowledge.* The following criteria are of particular importance:

- Clarity and precision of language
- Sophisticated vocabulary
- Logical structure and argument
- Mathematical accuracy, techniques and conceptual understanding

Before beginning the assessment, please read the following guidance and instructions carefully.

Depending on the course to which you have applied, you have been entered for Test 1 or 2. Before beginning the assessment please check that you have received the correct paper. A list of courses and corresponding papers can be found overleaf.

The assessment lasts three hours and **all three sections must be completed**. The marks for each section are weighted according to the paper. More time should be spent completing the sections with more marks attached. However, please note that to pass the UGAA a minimum grade in *all three sections* is required, as well as a good grade overall.

Test 1: Section A **(25%)**, Section B1 **(25%)**, Section D **(50%)**
Test 2: Section A **(25%)**, Section B2 **(50%)**, Section C **(25%)**

Answer Booklets

You must use the **BLUE** booklet for Sections A and B (English Sections) and the **YELLOW** booklet for Sections C or D (Maths Sections).

When answering the maths questions, you must show your working out, as well as your final answer.

- Dictionaries may **NOT** be used
- Hand-held calculators **MAY** be used.

If a calculator is used please indicate on the answer booklet the type used (e.g. TI.500)

Test Papers

TEST 1

BSc Actuarial Science (N321)
BSc Econometrics and Mathematical Economics (L140)
BSc Economic History with Economics (V3L1)
BSc Economics (L101)
BSc Economics and Economic History (VL31)
BSc Economics with Economic History (L1V3)
BSc Environmental Policy with Economics (F9L1)
BSc Finance (N300)
BSc Financial Mathematics and Statistics (GN13)
BSc Geography with Economics (L7L1)
BSc International Social and Public Policy and Economics (LLK1)
BSc Management (N200)
BSc Mathematics and Economics (GL11)
BSc Mathematics with Economics (G1L1)
BSc Mathematics, Statistics, and Business (G0N0)
BSc Philosophy and Economics (LV15)
BSc Philosophy, Politics and Economics (L0V0)
BSc Politics and Economics (LL12)

TEST 2

BSc Accounting and Finance (NN34)
BSc Anthropology and Law (ML16)
BSc Criminology (L611)
BSc Economic History (V300)
BSc Economic History and Geography (V3L7)
BSc Environment and Development (FK84)
BA Geography (L702)
BA History (V146)
BSc International Relations (L250)
BSc International Relations and Chinese (L2T1)
BSc International Relations and History (VL12)
BSc International Social and Public Policy (L400)
BSc International Social and Public Policy with Government (LL42)
BSc Language, Culture and Society (L3R9)
BSc Philosophy, Logic and Scientific Method (V503)
BSc Politics (L230)
BSc Politics and History (LV21)
BSc Politics and International Relations (L290)
BSc Politics and Philosophy (LV25)
BSc Psychological and Behavioural Science (C800)
BA Social Anthropology (L601)
BSc Social Anthropology (L603)
BSc Sociology (L301)

Please check you have received the correct paper. If you think you have received the wrong paper please notify the invigilator immediately.

The Undergraduate Admissions Assessment

TEST 1

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Section A

- **All** candidates should complete this section.
- This section has **one** question only.
- The marks achieved in this section account for **25%** of your final exam result.

Instructions:

Write a summary (précis) of the following passage, **in not more than 150 of your own words**. You must write a summary, not a discussion of the passage. No credit will be given for answers made up of sentences extracted from the original passage.

The world's leading climate scientists have warned there is only a dozen years for global warming to be kept to a maximum of 1.5C, beyond which even half a degree will significantly worsen the risks of drought, floods, extreme heat and poverty for hundreds of millions of people.

The authors of the landmark report by the UN Intergovernmental Panel on Climate Change (IPCC) released on Monday say urgent and unprecedented changes are needed to reach the target, which they say is affordable and feasible although it lies at the most ambitious end of the Paris agreement pledge to keep temperatures between 1.5C and 2C.

The half-degree difference could also prevent corals from being completely eradicated and ease pressure on the Arctic, according to the 1.5C study, which was launched after approval at a final plenary of all 195 countries in Incheon in South Korea that saw delegates hugging one another, with some in tears….

Policymakers commissioned the report at the Paris climate talks in 2016, but since then the gap between science and politics has widened. Donald Trump has promised to withdraw the US – the world's biggest source of historical emissions – from the accord. The first round of Brazil's presidential election on Sunday put Jair Bolsonaro into a strong position to carry out his threat to do the same and also open the Amazon rainforest to agribusiness.

Jonathan Watts, 'We Have 12 Years to Limit Climate Change Catastrophe, Warns UN,' *Guardian*, 8 October 2018

Please turn over for Section B.

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Section B1

- Complete Section B1 **ONLY** if you are completing Maths Section D.
- The marks achieved in this section account for **25%** of your final exam result.

Instructions:
Write **ONE** essay from the following three choices:

1. 'Social and political inequality is the biggest threat to Western democracy.' Discuss.
   - Why has social and economic inequality been on the rise in recent decades?

2. 'Political fragmentation is currently a more powerful force in world politics than globalisation.' Discuss.
   - How important is political fragmentation, compared to globalisation?

3. 'Tariffs undermine, rather than strengthen, a nation's economy.' Discuss.
   - What impacts do tariffs have on the economy?

Please turn over for Section D.

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Section D

- The marks achieved in this section account for **50%** of your final exam result.

- Full algebraic working out must be clearly shown.

Instructions:
This section has **seven questions**, with a total of **100 marks**. Answer **all** questions in this section.

Question 1

$f(x) = \frac{x-1}{x}$ and $g(x) = 3 - \frac{x-1}{x^2 - x}$

a) Write $g(x)$ as a single fraction in the form $\frac{ax+b}{cx+d}$ where a, b, c, d are integers.

(3 marks)

b) Find $\frac{f(x)}{g(x)}$ giving your answer in its simplest form.

(2 marks)

c) Find $g(f(x))$ giving your answer in its simplest form.

(3 marks)

d) Determine the number of real solutions to each of the following explaining your reasoning carefully:
i) $f(x) = g(x)$
ii) $x = f(x)$

(7 marks)
Total 15 marks

Question 2

Solve the following equations giving your answers exactly.

a) $x - 3 = 2\sqrt{x}$

(4 marks)

b) $\frac{e^x+4}{e^x} = 3e^x$

(4 marks)

c) $cosx - \frac{1}{cosx} = tanx$ for $0 \leq x \leq 2\pi$

(4 marks)

d) $log_2(x^2 + 3) = 2 + log_2 x$

(4 marks)
Total 16 marks

Question 3

For the curve $y = sin(x^2)$

a) Show that the roots are of the general form $x = \pm\sqrt{n\pi}$ (where n is an integer, $n \geq 0$).

(2 marks)

b) Show that the curve has a minimum point at the origin.

(7 marks)

c) Find a general form for the x coordinates of the other stationary points on the curve.

(3 marks)

d) Sketch the curve $y = sin(x^2)$ for $-\sqrt{2\pi} \leq x \leq \sqrt{2\pi}$

showing the intercepts with the axes and the exact values of the coordinates of the maximum and minimum points.

(4 marks)

Total 16 marks

Question 4

This question models the treatment of an illness.

Model 1

100 animals in veterinary hospital have a treatable illness and the treatment cures 10% of the animals each day, so that after 1 day there would be only 90 animals who had the illness.

a) Using this model how many animals would be expected to have the illness after
i) 5 days?
ii) n days?

(2 marks)

b) Using this model after how many days would the number of animals with the illness fall below 1?

(2 marks)

Model 2

In the same way as Model 1, there are 100 animals that have the illness initially and the treatment still cures 10% of the animals each day, but in this model 5 more animals with the illness arrive in the hospital at the end of each day. With this revised model there will be 95 animals with the illness after 1 day.

c) Using Model 2:
i) Show that Model 2 predicts that there will be 91 animals with the illness after 2 days.
ii) Find an expression for the number of animals with the illness after n days.
Give your answer in the form $a(0.9^n + b)$
iii) Based on this model is it possible for all the animals to be cured?
(Give a mathematical reason for your answer).

(6 marks)

Total 10 marks

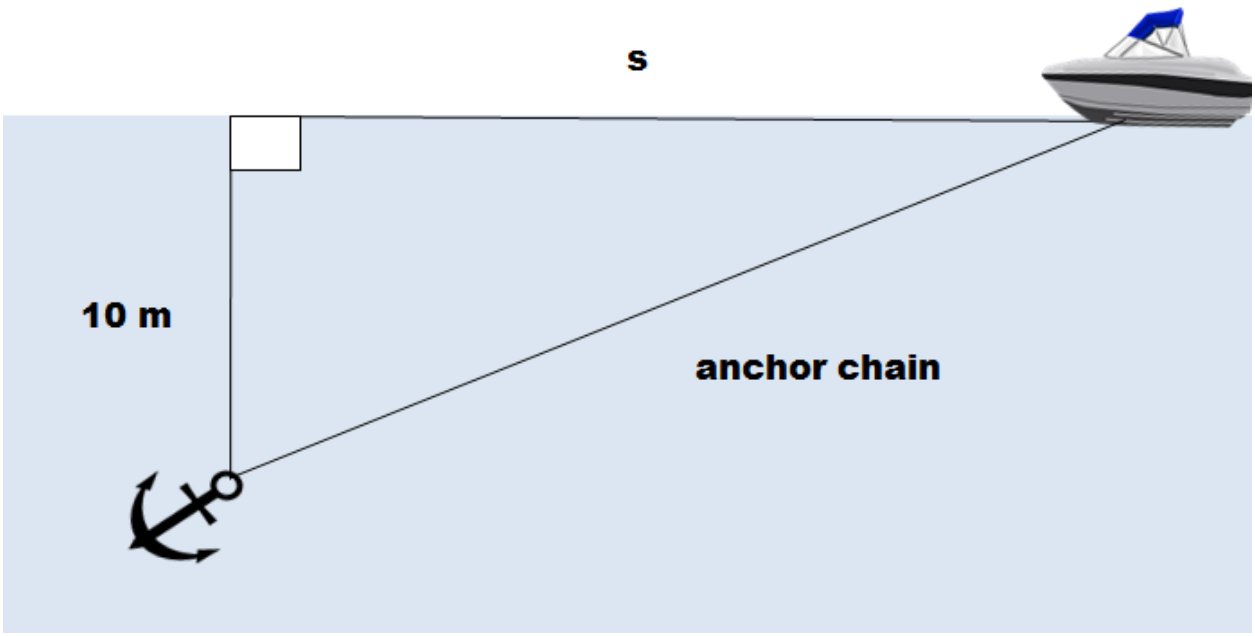
Question 5

It is recommended that the anchor chain on a boat is 8 times the depth of water.

a) A boat is anchored using the recommended length of chain for a water depth of 10m.

If the chain is fully tight find the distance s along the surface of the water that the boat is from the anchor point.

(1 mark)



b) The anchor chain is then pulled in at a constant rate of 20m/s.

i) Taking the length of the anchor chain as x show that $\frac{dx}{dt} = \frac{s}{x}\frac{ds}{dt}$

ii) Hence find the rate at which the boat is moving along the surface of the water at the point where the full chain was tight.

(6 marks)
Total 7 marks

Question 6

a) By differentiating $x = e^y$ with respect to y show that $\frac{d}{dx}(lnx) = \frac{1}{x}$

(3 marks)

b) Find $\frac{dy}{dx}$ for the following:

i) $y = x\ lnx$ ii) $y = \frac{x}{lnx}$ iii) $y = (lnx)^2$

(6 marks)

c) Find the following indefinite integrals:

i) $\int x\ ln\ x\ dx$ ii) $\int \frac{x}{1+x^2} dx$

(5 marks)

d) On the same axes sketch

$y = x\ lnx$ and $y = \frac{x}{lnx}$ for $x \geq 0$

You may assume that both curves meet at the origin.

For both curves show:

- the exact coordinates of any other intercepts with the x axis
- the equations of any asymptotes
- the exact coordinates of any stationary points
- the exact coordinates of any intersection points

(6 marks)
Total 20 marks

Question 7

a) i) Write down the equation of a circle centre the origin radius r.

ii) Explain why $\int_{-r}^{r} \sqrt{r^2 - x^2}\ dx$ represents the area of a semi circle.

ii) The quarter circle $0 \leq x \leq r$ and $0 \leq y \leq r$ is rotated by 2π radians about the x axis. Use calculus to find an exact expression for this volume.

iii) Explain how your answer relates to the volume of a sphere.

(7 marks)

b) i) Sketch the curve with equation $x^2 + (y - R)^2 = r^2$ showing R and r clearly on your sketch.

ii) Show that $y = R \pm \sqrt{r^2 - x^2}$

iii) Use your sketch to explain which parts of the curve correspond to each of the two solutions for y

iv) The region enclosed by the curve $x^2 + (y - R)^2 = r^2$ is rotated by 2π radians about the x axis. Use your answer to a) ii) to find an exact value for this volume in terms of R and r.

v) Describe the shape formed by this rotation.

(9 marks)
Total 16 marks

End of Test