TAKE-HOME ONLINE EXAMINATIONS APRIL – JUNE 2021

Please read through all instructions carefully before you start your exam

In most cases, the take-home online exam will be available for 23 hours and your answer(s) must be submitted before 9.00am UK time the day after your take-home online exam opens, unless you have been given a different deadline from your School.

Completing your take-home online exam

1. You need to download the question paper and any accompanying documents from Blackboard and your answers can be written in a Word document as you would for coursework (unless you have been given specific instructions from your School).
2. You are advised only to work on your answers for the duration of the time stated on the front page of the take-home online exam paper. You are not expected to work for 23 hours on your answer(s).
3. For some exams a timer will be applied so that, once started, you must submit within the specified time limit. Exams with a time limit will require you to submit either to a Blackboard test or to a Gradescope assignment. These will be clearly identified in Blackboard.
4. For exams which are time-restricted, and where you are required to upload your answers in a file, an extra 30 minutes will be added. This additional time is to allow you to scan any handwritten work and upload your file. Work submitted beyond this 30 minute period will be treated as late, and will not be marked.
5. Please read your exam paper thoroughly before you start to ensure that you understand what you need to do.
6. Do not exceed the specified word limits where they are stated.
7. You should use 12pt font size, Arial and 1.5 line spacing for word processed submissions.
8. Please write your 5-digit anonymous candidate number (from your RISIS exam timetable), module code and the number(s) of the question(s) answered on the top of each piece of work that you submit.
9. Save your work regularly as you are working on it.
10. You are responsible for the content of the work you upload and for the academic integrity of your answer(s).
11. Complete and upload your answer(s) to the submission point(s) in your Blackboard course.
12. You are responsible for organising your time and should aim to submit your answer(s) as early as possible to ensure your work is submitted prior to the deadline specified for your take-home online exam paper.

Full guidance can be found in the Take Home Exams area of this Blackboard course.

Submission

1. Please check the front of your take-home online exam paper and Blackboard for any specific instructions for uploading your work to submission point(s) for each paper.
2. You can submit multiple times for most exams (unless you have been told there is only one submission possible by your School), but you should ensure that your final version is uploaded before the deadline.
3. When submitting to Turnitin the 'submission title' must start with your 5-digit anonymous candidate number, followed by the module code. An example of a submission title is 12345 HS3DR.
4. You are responsible for ensuring that you have uploaded the correct document to the correct submission point. Some exams require submission of answers for different questions to different submission points.
5. You are responsible for ensuring that your file has been uploaded successfully. When you submit to a Turnitin, Blackboard or Gradescope 'variable-length' assignment you will receive an email receipt which you must keep. If you do not get this email receipt your work has not been submitted (check your spam folder).
   You will not receive an email receipt when you submit to a Blackboard Test or Gradescope Online Assignment.
   Please note that the final stage of a Turnitin submission requires you to confirm your submission by clicking 'Confirm'.
6. Please allow yourself plenty of time to upload and submit your answer(s) by the deadline. If you have problems submitting your answer(s) please email your work to take-home-exam@reading.ac.uk as soon as possible.
7. We will not be emailing reminders from the University ahead of exam papers and submission points opening, or non-submissions after the take-home exam submission has closed.
8. Guidance on how to submit files for your exams can be found at https://rdg.ac/takehomeexam

Full guidance can be found in the Take Home Exams area of this Blackboard course.

Where to get support

If you need support during your exam you can contact us on +44 (0) 118 378 7049

For technical issues (Blackboard and IT) you can also raise a ticket via the DTS Self Service Portal.

For other non-technical queries, please check the exams FAQs on Essentials or email take-home-exam@reading.ac.uk. Emails need to be sent from your University email account and you should provide your 5-digit candidate number.

Please note that ‘live’ support is available from 8:00am-5:00pm UK time Monday to Friday and will be available for limited hours 8:00am-9.30am UK time on Saturday morning during the exam period.

DAS registered students

1. If you have been provided with a green sticker, please attach this to the front page of your answer(s), as you would do for coursework submissions.
2. If you have any additional arrangements including extra time, you should consider the necessary requirements prior to the start of your exam and read the advice in the exam FAQs on Essentials.
3. If you still have queries please contact the Disability Advisory Service (DAS) or email take-home-exam@reading.ac.uk. Emails need to be sent from your University email account and you should provide your 5-digit candidate and student number.

IMPORTANT - You must read this before you start your exam

Academic Integrity

We are treating this online examination as a time-limited open assessment. This means that:

1. You are permitted to refer to published materials to aid you in your answers.
2. Published sources must be referenced. This includes all on-line sources.
3. Over-reliance on published sources is considered to be poor academic practice.

Apart from appropriate referencing, you must ensure that:

a. the work you submit is entirely your own;
b. you do not communicate with other students on the topic of this assessment for the whole time the assessment is live;
c. you do not obtain advice or contribution from any third party, including proof-readers, friends, or family members.
d. For advice on academic integrity, you can see the University Library’s Academic Integrity Toolkit.

You should note that:

1. Failure to adhere to these requirements will be considered a breach of the Academic Misconduct regulations (available here), where the offences of cheating, plagiarism, collusion, copying, and commissioning are particularly relevant.
2. Your exam answers will be run through Turnitin, and the usual similarity reports will be available to markers.

Please read and note this statement of originality:

By submitting this work I certify that:

1. **it is my own unaided work;**
2. **the use of material from other sources has been properly and fully acknowledged in the text;**
3. **neither this piece of work nor any part of it has been submitted in connection with another assessment;**
4. **I have read the University's definition of plagiarism, guidance on good academic practice and the guidelines set out above; and**
5. **I will comply with the requirements these place on me.**

I acknowledge the University may use appropriate software to detect similarities with other third-party material, in order to ensure the integrity of the assessment.

I understand that if I do not comply with these requirements the University will take action against me, which if proven and following the proper process may result in failure of the year or part and/or my removal from membership of the University.

With best wishes and good luck for your take-home online exams over the coming period.

Please read the instructions below before you start the exam.

April/May 2021 **CS3AI18 2020/1 A 800**

UNIVERSITY OF READING

ARTIFICIAL INTELLIGENCE (CS3AI18)

One and a half hours

Answer any **TWO** out of THREE Questions.

If a word limit is not specified next to a QUESTION then EACH QUESTION (e.g. Q1, Q2, Q3, etc.) has a word limit of 1000 words.
This limit excludes scanned images of diagrams or hand-written formulas but includes images with hand-written text.

Submit your answers to **EACH QUESTION** SEPARATELY to the relevant submission point on Blackboard.

EACH Question is worth 20 marks.

1. Consider a scenario where a robotic agent, which is stuck in a building comprised of several rooms, is to be trained to escape the building to the "Free world". Given the building's Floor plan (shown in Figure Q1-1), a learning rate of 0.8, and a reward 100 points if the agent can escape from a room and zero otherwise, answer the following in the context of this scenario:

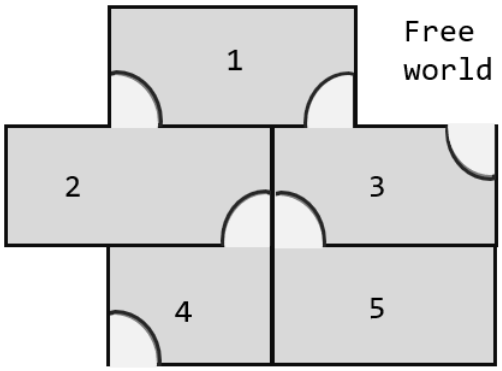

Figure Q1-1: Building's Floor Plan

(a) Explain the components of the reinforcement learning intelligent agent's interaction with the environment for the given scenario.

(2 marks)

(b) Q-learning, a policy-based reinforcement learning, is to be used. Describe the Q-function's components for the above-mentioned agent.

(3 marks)

(c) Compute the following for this agent in the context reinforcement learning:

(i) State diagram and links labelled with Reward.
(ii) Initial Reward and Q matrices.
(iii) Q-value if the of the agent is in room 5.
(iv) Updated Q matrices.

(12 marks)

(d) Briefly explain how a supervised learning agent would help this robot escape the building.

(3 marks)

2. Answer Question 2(a) and 2(b) by annotating copies of Figure Q2-1 on your answer sheet.

(a) Alpha-beta pruning improves search speed by pruning branches of a Minmax game tree. Show which branches the alpha-beta pruning algorithm will prune in the following game tree. Write next to Min player nodes (indicated as Downward triangle) and Max player nodes (indicated as Upward triangle) the value that nodes will play.

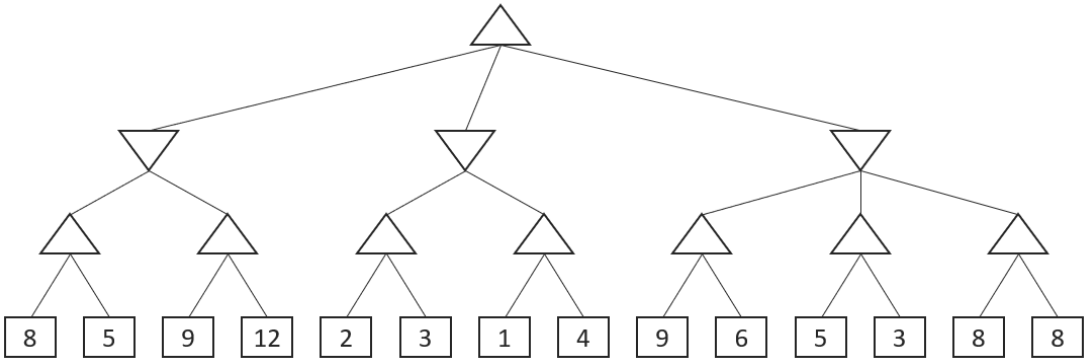

Figure Q2-1: Game Tree (7 marks)

(b) Show the sequence of nodes (number the nodes of Figure Q2-1) visited by a breadth-first search and a depth-first search algorithms. (5 marks)

(c) Find an optimal path between S and T using the A* algorithm from the city distance graph shown in Figure Q2-2. List the calculated values for each node of the optimal path. Justify your answer by citing a non-optimal path. In Figure Q2-2, S is the start state and T is the goal state; each node has a city name (S, A, B, C, D, T) and its respective heuristic value, and links show the distance from one city node to another. What admissible heuristic would you use for the problem in Figure Q2-2?

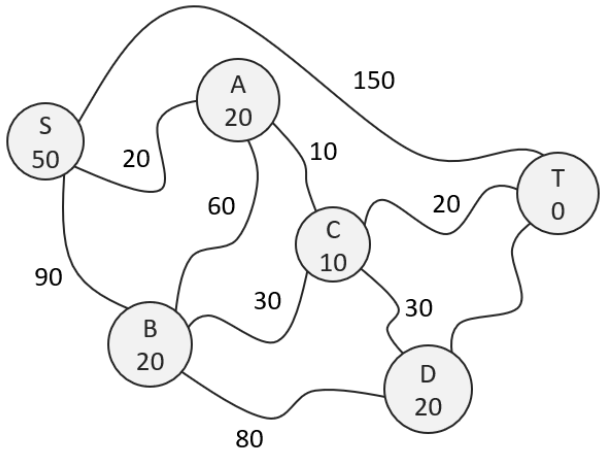

Figure Q2-2: City distance graph (8 marks)

3. Consider the three-layer network shown in Figure Q3-1, where hidden and output nodes have sigmoid activation.

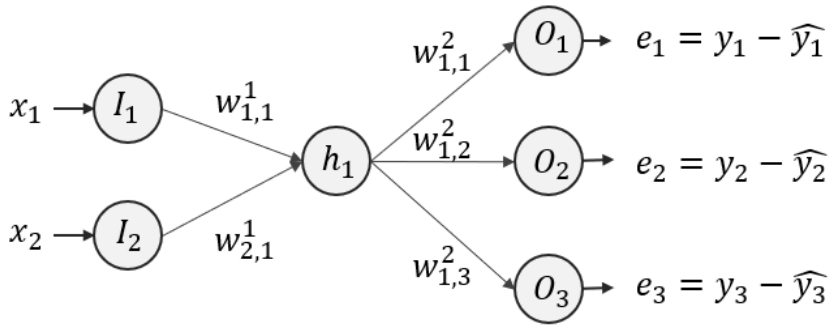

Figure Q3-1: Three-layer network

(a) Show how you back-propagate errors $e_1, e_2$and e_3 to compute the gradient for hidden layer node h_1 and inputs layer nodes I_1 and I_2. Show expressions for each weight $w^1_{j,i}$ and $w^2_{k,j}$ where i, j, k respectively are indices of the nodes at the input, hidden, and output layers. The network shown in Figure Q3-1 takes x_i and y_i as its inputs and outputs, respectively.

(7 marks)

(b) If you were to train the above network for regression and classification problems what loss functions would you use for the respective problem. (2 marks)

(c) Suppose the network in Figure Q3-1 is modified and 100 hidden layers are added between the input and output layers, and you found the network is not converging. What would you do to enhance its convergence ability? Justify your choice.

(3 marks)

(d) If you were asked not to use sigmoid activation in the output layer because it proved inefficient for a classification task, what other activation would you use? Justify your choice.

(3 marks)

(e) Do you think the loss function you selected while answering question 3(b) will still be efficient and if not what other loss function would you use? (3 marks)

(f) How do you modify network parameters to prevent overfitting?

(2 marks)

(End of Question Paper)