XJTLU Entrepreneur College (Taicang) Cover Sheet

Module code and Title	MFE204TC Artificial Intelligence and Data Analysis
School Title	School of Artificial Intelligence and Advanced Computing
Assignment Title	Coursework (CW)
Submission Deadline	5 pm China time (UTC+8 Beijing) on Friday 18th December
Final Word Count	NA
If you agree to let the university use your work anonymously for teaching and learning purposes, please type **"yes"** here.	

I certify that I have read and understood the University's Policy for dealing with Plagiarism, Collusion and the Fabrication of Data (available on Learning Mall Online). With reference to this policy I certify that:

- My work does not contain any instances of plagiarism and/or collusion.
  My work does not contain any fabricated data.

By uploading my assignment onto Learning Mall Online, I formally declare that all of the above information is true to the best of my knowledge and belief.

Scoring – For Tutor Use	
Student ID	

Stage of Marking	**Marker Code**	**Learning Outcomes Achieved （F/P/M/D） (please modify as appropriate)**			**Final Score**
		A	**B**	**C**	
1st Marker – red pen					
Moderation – green pen	**IM Initials**	The original mark has been accepted by the moderator (please circle as appropriate):			Y / N
		Data entry and score calculation have been checked by another tutor (please circle):			Y
2nd Marker if needed – green pen					

For Academic Office Use			**Possible Academic Infringement (please tick as appropriate)**	
Date Received	**Days late**	**Late Penalty**	☐ **Category A**	Total Academic Infringement Penalty (A,B, C, D, E, Please modify where necessary) _____
			☐ **Category B**	
			☐ **Category C**	
			☐ **Category D**	
			☐ **Category E**	

Instructions to Students

The assignment must be typed in an MS Word document and submitted via Learning Mall Online to the correct drop box. Only electronic submission is accepted and no hard copy submission.

All students must download their file and check that it is viewable after submission. Documents may become corrupted during the uploading process (e.g. due to slow internet connections). However, students themselves are responsible for submitting a functional and correct file for assessments.

Assessment tasks:

Please answer all SIX questions.

Q1. Examine the AI literature to discover whether the following tasks can currently be undertaken by computers: (20 marks, 1 mark for each correct judgment and 1 mark for each correct explanation.)

a. Playing a decent game of table tennis (Ping-Pong).
b. Driving in the center of Cairo, Egypt.
c. Driving in Victorville, California.
d. Buying a week's worth of groceries at the market.
e. Buying a week's worth of groceries on the Web.
f. Playing a decent game of bridge at a competitive level.
g. Discovering and proving new mathematical theorems.
h. Writing an intentionally funny story.
i. Giving competent legal advice in a specialized area of law.
j. Translating spoken English into spoken Swedish in real time.
For the currently infeasible tasks, try to find out what the difficulties are and predict when, if ever, they will be overcome.

Q2. This exercise explores the differences between agent functions and agent programs. (20 marks, 2 marks for each correct judgment and 2 marks for each correct explanation.)
a. Can there be more than one agent program that implements a given agent function? Give an example, or show why one is not possible.
b. Are there agent functions that cannot be implemented by any agent program?
c. Given a fixed machine architecture, does each agent program implement exactly one agent function?
d. Given an architecture with n bits of storage, how many different possible agent pro- grams are there?
e. Suppose we keep the agent program fixed but speed up the machine by a factor of two. Does that change the agent function?

Q3. Give the name of the algorithm that results from each of the following special cases: (10 marks, 2 marks for correct each answer)

a. Local beam search with $k = 1$.

b. Local beam search with one initial state and no limit on the number of states retained.

c. Simulate annealing with $T = 0$ at all times (and omitting the termination test).

d. Simulate annealing with $T = \infty$ at all times.

e. Genetic algorithm with population size $N = 1$.

Q4. Use the AC-3 algorithm to show that arc consistency can detect the inconsistency of the partial assignment {*green, blue, red*} for the problem shown in the following Figure. (20 marks, Each executive step is 2 marks.)

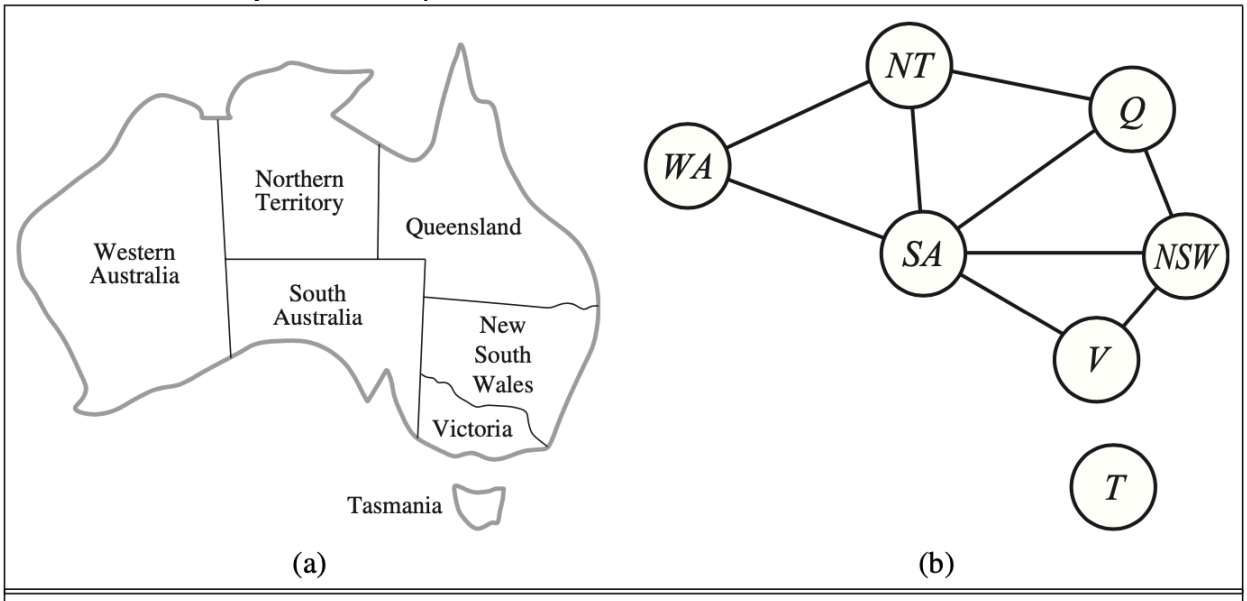


Figure 6.1 (a) The principal states and territories of Australia. Coloring this map can be viewed as a constraint satisfaction problem (CSP). The goal is to assign colors to each region so that no neighboring regions have the same color. (b) The map-coloring problem represented as a constraint graph.

Q5. Given the action schemas and initial state from Figure *airport-pddl-algorithm*, what are all the applicable concrete instances of *Fly(p, from, to)*
in the state described by (10 marks, Each executive step is 2 marks.)

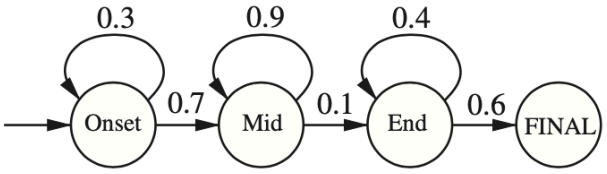
At(P1,JFK) ∧ At(P2,SFO) ∧ Plane(P1) ∧ Plane(P2) ∧ Airport(JFK) ∧ Airport(SFO) ?

$Init(At(C_1, SFO) \land At(C_2, JFK) \land At(P_1, SFO) \land At(P_2, JFK)$
$\land Cargo(C_1) \land Cargo(C_2) \land Plane(P_1) \land Plane(P_2)$
$\land Airport(JFK) \land Airport(SFO))$
$Goal(At(C_1, JFK) \land At(C_2, SFO))$
$Action(Load(c, p, a),$
PRECOND: $At(c, a) \land At(p, a) \land Cargo(c) \land Plane(p) \land Airport(a)$
EFFECT: $\neg At(c, a) \land In(c, p))$
$Action(Unload(c, p, a),$
PRECOND: $In(c, p) \land At(p, a) \land Cargo(c) \land Plane(p) \land Airport(a)$
EFFECT: $At(c, a) \land \neg In(c, p))$
$Action(Fly(p, from, to),$
PRECOND: $At(p, from) \land Plane(p) \land Airport(from) \land Airport(to)$
EFFECT: $\neg At(p, from) \land At(p, to))$

Figure 10.1 A PDDL description of an air cargo transportation planning problem.

Q6. Question 5: Calculate the most probable path through the HMM in the following figure for the output sequence [C_1, C_2, C_3, C_4, C_4, C_6, C_7]. Also give its probability. (20 marks, correct explanation 2 marks, each executive step is 2 marks.)

Phone HMM for [m]:



Output probabilities for the phone HMM:

Onset:	Mid:	End:
C_1: 0.5	C_3: 0.2	C_4: 0.1
C_2: 0.2	C_4: 0.7	C_6: 0.5
C_3: 0.3	C_5: 0.1	C_7: 0.4

Figure 23.16 An HMM for the three-state phone [m]. Each state has several possible outputs, each with its own probability. The MFCC feature labels C_1 through C_7 are arbitrary, standing for some combination of feature values.

[END OF COURSEWORK QUESTIONS]

Marking Criteria

-The overall marking criterial for this coursework as a whole is below.

The following table indicates what is expected for each classification category, highlighting generic marking criteria that brings together expectations in performance for each percentage (or alphabetical) band, and the criteria that needs to be satisfied.

Generic Marking Criteria

Grade	Point Scale		Criteria to be satisfied
A	81+	First	➢ Outstanding work that is at the upper limit of performance. ➢ Work would be worthy of dissemination under appropriate conditions. ➢ Mastery of advanced methods and techniques at a level beyond that explicitly taught. ➢ Ability to synthesise and employ in an original way ideas from across the subject. ➢ In group work, there is evidence of an outstanding individual contribution. ➢ Excellent presentation. ➢ Outstanding command of critical analysis and judgment.
B	70 – 80	First	➢ Excellent range and depth of attainment of intended learning outcomes. ➢ Mastery of a wide range of methods and techniques. ➢ Evidence of study and originality clearly beyond the bounds of what has been taught.

			➢ In group work, there is evidence of an excellent individual contribution. ➢ Excellent presentation. ➢ Able to display a command of critical thinking, analysis and judgment.
C	60 – 69	Upper Second	➢ Attained all the intended learning outcomes for a module or assessment. ➢ Able to use well a range of methods and techniques to come to conclusions. ➢ Evidence of study, comprehension, and synthesis beyond the bounds of what has been explicitly taught. ➢ Very good presentation of material. ➢ Able to employ critical analysis and judgement. ➢ Where group work is involved there is evidence of a productive individual contribution
D	50- 59	Lower Second	➢ Some limitations in attainment of learning objectives but has managed to grasp most of them. ➢ Able to use most of the methods and techniques taught. ➢ Evidence of study and comprehension of what has been taught ➢ Adequate presentation of material. ➢ Some grasp of issues and concepts underlying the techniques and material taught.

			➢ Where group work is involved there is evidence of a positive individual contribution.
E	40 – 49	Third	➢ Limited attainment of intended learning outcomes. ➢ Able to use a proportion of the basic methods and techniques taught. ➢ Evidence of study and comprehension of what has been taught, but grasp insecure. ➢ Poorly presented. ➢ Some grasp of the issues and concepts underlying the techniques and material taught, but weak and incomplete.
F	0 – 39	Fail	➢ Attainment of only a minority of the learning outcomes. ➢ Able to demonstrate a clear but limited use of some of the basic methods and techniques taught. ➢ Weak and incomplete grasp of what has been taught. ➢ Deficient understanding of the issues and concepts underlying the techniques and material taught. ➢ Attainment of nearly all the intended learning outcomes deficient. ➢ Lack of ability to use at all or the right methods and techniques taught. ➢ Inadequately and incoherently presented. ➢ Wholly deficient grasp of what has been taught.

			➢ Lack of understanding of the issues and concepts underlying the techniques and material taught. ➢ Incoherence in presentation of information that hinders understanding.
G	0	Fail	➢ No significant assessable material, absent, or assessment missing a ″must pass″ component.