

**Calculator instructions:**

- You are allowed to use a nonprogrammable calculator only from the following list of approved models in this exam:
  - Casio fx-82, fx-83, fx-85

**Dictionary instructions:**

- You are not allowed to use your own dictionary in this exam. A basic English dictionary is available to use: raise your hand and ask an invigilator, if you need it.

**Exam information:**

- There are 6 pages to this exam.
- This is an open book exam. Any written or printed material is permitted.
- There will be **2 hours** to complete this exam.

Please do not remove this paper from the exam venue.

### Question 1

This question is related to a **hypothetical personalised news reader** system which maintains a profile of each user including:

gender, age, job, list-of-interests,

where list-of-interests is a subset of

{Art, Education, Finance, Politics, Science, Society, Sport, Travel}.

Consider the following stereotypes:

#### PROFESSIONAL\_FINANCIAL\_READER:

**Trigger:** (age>22) and (age<60) and (job in Professional-jobs) and ((list-of-interests includes Finance) or (list-of-interests includes Politics) or (list-of-interests includes Society))

P=0.7

Facets	Degree of interest	Ratings (out of 100)
Business news	High	90
Stocks and shares	High	80
Local news	High	70
International news	High	70
Holidays	Moderate	70
Online courses	Low	40
Music	Moderate	50
Sport	Moderate	50
Gossips	Low	70
Technology	High	70
Science	Moderate	60
Movies	Moderate	70

**YOUNG\_TRAVELLER:**

**Trigger:** (age>16) and age<30) and (list-of-interests includes Travel)

P=0.8

Facets	Degree of interest	Ratings (out of 100)
Business news	Low	60
Stocks and shares	Low	60
Holidays	High	80
Online courses	Moderate	70
Music	High	80
Gossips	High	70
Movies	High	80

**POLITICALLY\_ENGAGED\_ADULT:**

**Trigger:** (age>25) and (age<60) and ((list-of-interests includes Politics) or (list-of-interests includes Society))

P=0.9

Facets	Degree of interest	Ratings (out of 100)
Business news	Moderate	60
Stocks and shares	Moderate	90
Local news	High	100
International news	High	90
Gossips	Low	80
Technology	Moderate	60
Science	Moderate	60

(a) What do the values of the ratings for the facet **Business news** mean in the stereotypes **PROFESSIONAL\_FINANCIAL\_READER** and **YOUNG\_TRAVELLER**?

[2 marks]

(b) Cite an example from the tables that illustrates one problem with stereotypes.

[2 marks]

(c) Consider a user U with the following profile:

```
gender=male, age=40, job=manager,  
list-of-interests = {Finance, Politics, Sport, Travel}
```

Calculate the probability for the user to have high interest in business news and high interest in local news. Show your working.

[6 marks]

(d) What is a **scrutable user model** and what are the claimed benefits? Suggest how a scrutable user model could be implemented for this scenario.

[6 marks]

(e) Imagine that you are a consultant with expertise in adaptive information systems. You are asked by the news publisher to suggest **one further adaptive feature** to add to this system and what extra information you would need to capture for the user profile.

[4 marks]

[question 1 total: 20 marks]

## Question 2

A city council has a strategy to expand the tourism sector for the city. Part of their plan is to develop a mobile personalised city guide which can recommend to visitors nearby places of interests, good food and special events when they are visiting the city.

According to Burke (2002), three key features of recommender algorithms are:

- Background data;
- Input data;
- Algorithm.

(a) Compare and contrast **collaborative filtering algorithms** with **content-based algorithms** on these three key features in the case of the mobile personalised city guide outlined above. Your answer should include illustrative examples from the city guide, describing how the three key features of recommender algorithms are addressed by each of these two classes of algorithms.

[12 marks]

- (b) Discuss **one benefit** and **one limitation** for both approaches (collaborative filtering and content-based filtering) to provide recommendations of nearby places of interest.

[4 marks]

- (c) Assume that the city guide includes a new feature to recommend restaurants to a group of users. Paul, John, Marry, and Jane are registered users of the system and their prediction values for eight restaurants are given in the following matrix:

	<i>R1</i>	<i>R2</i>	<i>R3</i>	<i>R4</i>	<i>R5</i>	<i>R6</i>	<i>R7</i>	<i>R8</i>
<i>Paul</i>	3	5	1	7	5	1	4	9
<i>John</i>	5	6	9	10	2	3	7	1
<i>Marry</i>	2	4	5	8	1	4	5	8
<i>Jane</i>	4	6	10	5	6	7	3	5

Use the **Least misery strategy** to identify a restaurant to recommend to the group. Show your working. Use the example to point at one advantage of the “Least misery strategy” over the “Average strategy”.

[4 marks]

[question 2 total: 20 marks]

### Question 3

This question relates to a **hypothetical regional newspaper** which covers a wide range of topics of local interests. The publisher plans to launch a personalised online service on a subscription basis. Readers can subscribe to a list of chosen topics, which allows them to access articles and announcements that are related to these topics. This regional newspaper plans to deliver an adaptive feature which will recommend new articles and announcements that are of interest to the readers.

- (a) Use **Jameson's schema**, which was introduced in lectures, to explain how user subscription information can be used to offer personalised recommendation of new articles and announcements.

[6 marks]

- (b) Consider an adaptive system that recommends articles to users. The matrix  $M$  below indicates which articles  $a_1, \dots, a_7$  were liked by which reader  $r_1, \dots, r_5$  (value 1 indicates that the reader liked the article). Assume that  $r_3$  would like a suggestion for which articles may be interesting to read. Apply **Amazon's item-item collaborative filtering** algorithm to find the most suitable article to recommend to  $r_3$ . Show your working.

$$M = \begin{matrix} & \begin{matrix} r_1 & r_2 & r_3 & r_4 & r_5 \end{matrix} \\ \begin{matrix} a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \\ a_7 \end{matrix} & \begin{bmatrix} 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 \end{bmatrix} \end{matrix}$$

[8 marks]

- (c) Describe how Amazon's item-item filtering algorithm addresses the **scalability problem** usually associated with collaborative filtering algorithms.

[2 marks]

- (d) Describe one **usability challenge** brought by Amazon's item-item filtering and suggest a way to overcome this.

[4 marks]

[question 3 total: 20 marks]