Simple Pattern Recognition and Decision Making

Standard difficulty · 20 questions · 40 marks · Time: 37 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. Using what we have seen before to decide what to do is:

(a) debugging **(b)** decomposing

(c) guessing at random **(d)** making a decision from observations

2. A parcel sorter uses: Rule 1: if weight > 15 kg, label "Heavy". Rule 2: otherwise, if length > 60 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) A parcel weighs 26 kg and is 100 cm long. Which label does it get?

(a) Small **(b)** Long **(c)** Heavy and Long **(d)** Heavy

3. A parcel sorter uses: Rule 1: if weight > 10 kg, label "Heavy". Rule 2: otherwise, if length > 60 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) Parcels (weight, length): (1 kg, 115 cm), (16 kg, 115 cm), (11 kg, 40 cm), (13 kg, 50 cm), (12 kg, 65 cm). How many are labelled "Long"?

(a) 3 **(b)** 0 **(c)** 2 **(d)** 1

4. A model learned from these labelled examples: 37 → Yes, 36 → Yes, 20 → No, 43 → Yes, 31 → Yes, 11 → No. Which rule fits ALL of them?

(a) the number is odd **(b)** the number has two equal digits

(c) the number is more than 20 **(d)** the number is a multiple of 4

5. Buses leave a stop at 7:10, 7:40, 8:10, 8:40 a.m. and keep the same pattern. When does the second bus after the last one shown leave?

(a) 9:50 a.m. **(b)** 9:35 a.m. **(c)** 10:10 a.m. **(d)** 9:40 a.m.

6. A pattern repeats: cow, hen, hen, cow, hen, hen, cow, hen, … What is the 85th item?

(a) cat **(b)** hen **(c)** dog **(d)** cow

7. For each mark in the list, if mark ≥ 60 print "Pass", otherwise print "Try again". How many times is "Pass" printed? Marks: 16, 76, 95, 23, 89, 64, 70, 28

(a) 4 **(b)** 3 **(c)** 5 **(d)** 6

8. Rule: carry an umbrella if it is cloudy OR the humidity is more than 65%.
Mon: cloudy, humidity 90%
Tue: cloudy, humidity 90%
Wed: cloudy, humidity 70%
Thu: cloudy, humidity 80%
Fri: cloudy, humidity 65%
Sat: cloudy, humidity 70%
On how many of these days do you carry an umbrella?

(a) 6 **(b)** 2 **(c)** 1 **(d)** 0

Section B — Short answer — 8 × 2 = 16 marks

9. What is a decision tree?

10. A parcel sorter uses: Rule 1: if weight > 30 kg, label "Heavy". Rule 2: otherwise, if length > 60 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) A parcel weighs 24 kg and is 40 cm long. Which label does it get?

11. A parcel sorter uses: Rule 1: if weight > 30 kg, label "Heavy". Rule 2: otherwise, if length > 30 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) Parcels (weight, length): (54 kg, 30 cm), (21 kg, 45 cm), (59 kg, 15 cm), (29 kg, 50 cm), (17 kg, 45 cm). How many are labelled "Heavy"?

12. Buses leave a stop at 7:15, 7:55, 8:35, 9:15 a.m. and keep the same pattern. When does the next bus leave?

13. A pattern repeats: D, C, A, B, D, C, A, B, D, C, … What is the 72nd item?

14. For each mark in the list, if mark ≥ 40 print "Pass", otherwise print "Try again". How many times is "Pass" printed? Marks: 67, 11, 21, 10, 67, 84, 79, 20

15. Rule: carry an umbrella if it is cloudy AND the humidity is more than 70%.
Mon: clear, humidity 55%
Tue: clear, humidity 90%
Wed: cloudy, humidity 75%
Thu: clear, humidity 50%
Fri: cloudy, humidity 95%
Sat: cloudy, humidity 60%
On how many of these days do you carry an umbrella?

16. Animal pictures are described by two numbers (ear shape score, snout length score) and labelled: (19, 5) cat; (20, 17) dog; (10, 3) cat; (14, 6) dog; (5, 19) cat; (10, 17) dog. A new picture scores (14, 13). A nearest-neighbour model gives it the label of the closest example, measuring distance as the difference in the first number plus the difference in the second. Which label does it give?

Section C — Word problems — 4 × 4 = 16 marks

17. Draw (in words) a decision tree to decide what to wear: Is it raining? Is it cold? Give the four possible decisions.

18. (a) A parcel sorter uses: Rule 1: if weight > 15 kg, label "Heavy". Rule 2: otherwise, if length > 40 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) A parcel weighs 13 kg and is 10 cm long. Which label does it get?
(b) A parcel sorter uses: Rule 1: if weight > 20 kg, label "Heavy". Rule 2: otherwise, if length > 30 cm, label "Long". Rule 3: otherwise, label "Small". (Check the rules in order.) Parcels (weight, length): (2 kg, 50 cm), (31 kg, 35 cm), (20 kg, 45 cm), (21 kg, 15 cm), (32 kg, 45 cm). How many are labelled "Small"?

19. (a) Buses leave a stop at 6:45, 7:00, 7:15, 7:30 a.m. and keep the same pattern. When does the third bus after the last one shown leave?
(b) Rule: carry an umbrella if it is cloudy AND the humidity is more than 65%.
Mon: clear, humidity 80%
Tue: cloudy, humidity 85%
Wed: clear, humidity 55%
Thu: cloudy, humidity 50%
Fri: clear, humidity 60%
Sat: clear, humidity 90%
On how many of these days do you carry an umbrella?

20. Animal pictures are described by two numbers (ear shape score, snout length score) and labelled: (7, 16) cat; (1, 5) dog; (17, 7) cat; (17, 5) dog; (6, 6) cat; (13, 9) dog. A new picture scores (14, 18). A nearest-neighbour model gives it the label of the closest example, measuring distance as the difference in the first number plus the difference in the second. Which label does it give?

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Answer key

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Q	Answer	Working
1	**(d) making a decision from observations**	—
2	**(d) Heavy**	26 > 15, so Rule 1
3	**(d) 1**	Long, Heavy, Heavy, Heavy, Heavy
4	**(c) the number is more than 20**	"the number is more than 20" gives every label; each other rule gets at least one example wrong
5	**(d) 9:40 a.m.**	a bus every 30 minutes; 8:40 + 2 × 30 min
6	**(d) cow**	the block of 3 repeats; 85 = 3 × 28 + 1, so it is item 1 of the block
7	**(c) 5**	marks of 60 or more: 76, 95, 89, 64, 70
8	**(a) 6**	days that fit: Mon, Tue, Wed, Thu, Fri, Sat
9	**A diagram of yes/no questions (rules) where each answer leads down a branch to a decision.**	—
10	**Small**	24 is not more than 30; 40 is not more than 60, so Rule 3
11	**2**	Heavy, Long, Heavy, Long, Long
12	**9:55 a.m.**	a bus every 40 minutes; 9:15 + 1 × 40 min
13	**B**	the block of 4 repeats; 72 = 4 × 17 + 4, so it is item 4 of the block
14	**4**	marks of 40 or more: 67, 67, 84, 79
15	**2**	days that fit: Wed, Fri
16	**dog**	closest is (14, 6) at distance 7
17	**Raining? Yes → Cold? Yes: raincoat and sweater; No: raincoat. Raining? No → Cold? Yes: sweater; No: light clothes.**	—
18	**(a) Small; (b) 0**	(a) 13 is not more than 15; 10 is not more than 40, so Rule 3; (b) Long, Heavy, Long, Heavy, Heavy
19	**(a) 8:15 a.m.; (b) 1**	(a) a bus every 15 minutes; 7:30 + 3 × 15 min; (b) days that fit: Tue
20	**cat**	closest is (7, 16) at distance 9

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