Take Home Test

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Rules:

1. There are three questions in this test paper that cover different scopes.

2. You may skip the questions that you are unfamiliar with. However, you are encouraged to give it a try to show us your effort.

3. You may answer the questions by writing (hardcopy) or using a programming language that you are familiar with.

4. Cite/give credit to any reference material/websites/resources that you have referred while answering the questions. This is to show your answer's originality.

5. Please submit your answers within the time assigned by the panel. Any submission later than the given time without a valid reason will not be accepted.

6. DO NOT share/circulate this test paper to anyone else.

———————————— Good Luck ————————————

Question 1: Data Processing and Decision Making

Scenario: Adam wants to buy a new car for his beloved son. He did a little market survey by visiting several car vendors. The table below shows the information of some cars that Adam is interested in.

Question: If you are Adam, which car would you purchase? Explain using any optimization technique/logical deduction/algorithm that you are familiar with.

Car	Fuel consumption (l/100km)	Fuel tank capacity (l)	Car price (RM)	Annual service cost (RM)
A	5.6	42	65 000	2 030
B	6.0	41	69 000	1 790
C	7.5	40	73 836	2 100
D	6.5	55	79 944	1 800
E	5.2	44	76 888	2 250
F	6.3	42	75 000	1 990
G	5.3	43	92 925	1 880

# Question 2: Scheduling and Operation Research

Scenario: Adam and Ben were playing in the school's hall without their teacher's permission. They were punished to clean up the storeroom by moving some boxes to the given coordinates (refer the grid and table below).

Question: Given that Adam and Ben starts at $(3, 2)$ and $(9, 3)$ respectively, design a work schedule for the boys so that they can complete the task together in the quickest way (ignore any path collision).

Assume that the grid is 4-directed (U, D, L, R movement only) and each step takes one unit of time and they do not take a break throughout the task.

Expected Output: Adam: I $\to$ III; Ben: IV $\to$ II $\to$ V

| Box	Initial position	move the box to
I	$(0, 0)$	$(4, 4)$
II	$(7, 9)$	$(0, 2)$
III	$(5, 5)$	$(8, 1)$
IV	$(5, 0)$	$(9, 7)$
V	$(1, 8)$	$(6, 3)$
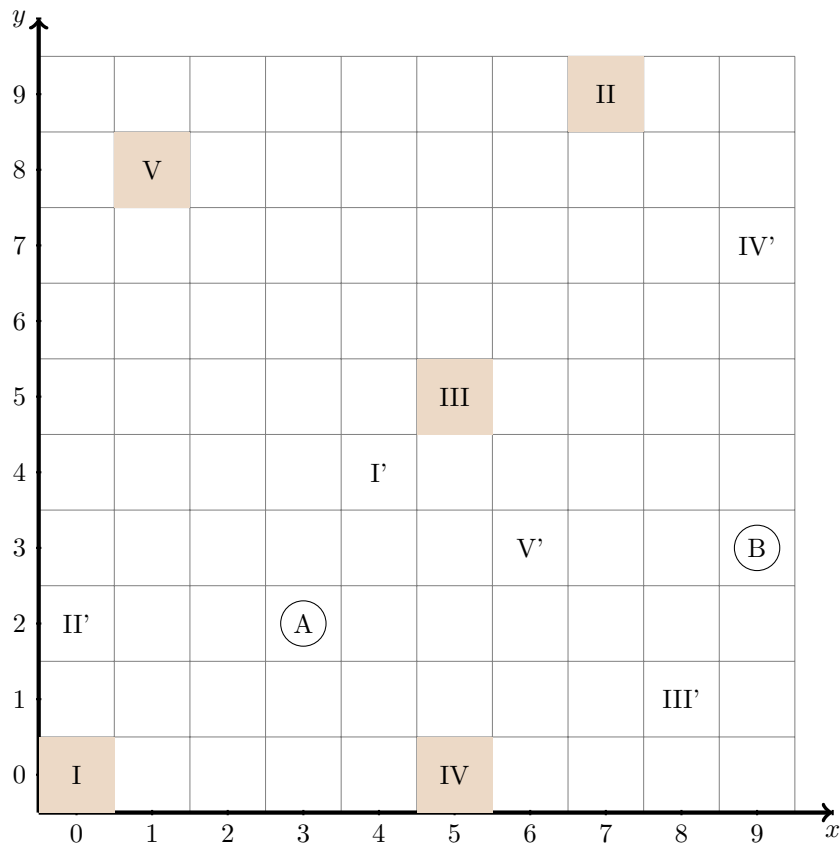
Question 3: Geometry and Programming

Scenario: Given an unbounded grid that is made up of rectangular cells with length l and width w. Point C is located at the center of one of the cell.

Question: Write a simple program to find the number of rectangular cells that can be fully covered by a circle with radius r and center C. Refer to the figure below for an example. Assume that all l, w, and r have the same unit of measurement.

Use your code to verify the following results.

- $l = 2, w = 1, r = 4$: number of cells that are fully covered $= 17$

- $l = 10, w = 15, r = 100$: number of cells that are fully covered $= 179$

- $l = 750, w = 550, r = 20000$: number of cells that are fully covered $= 2923$
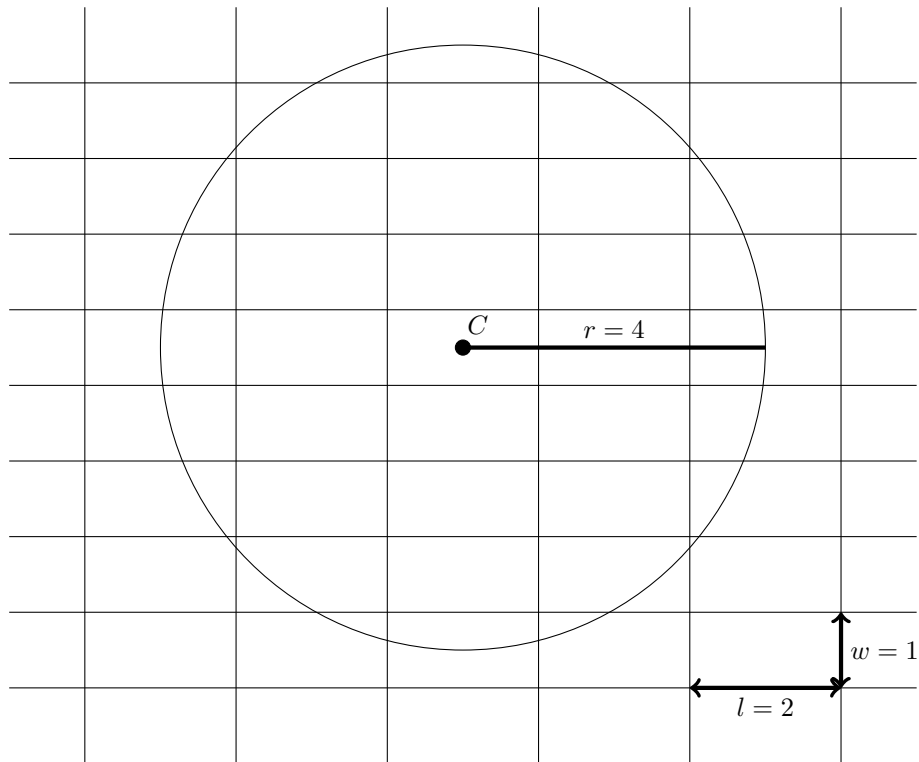
Example: $l = 2$, $w = 1$, $r = 4$, number of cells that are fully covered $= 17$.