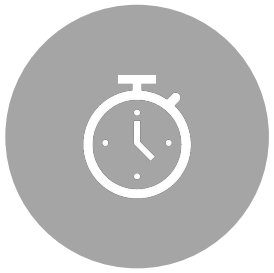
JURUSAN TEKNOLOGI INFORMASI

Critical Thinking & Problem Solving
Course 06. Basic Problem Solving Skills (Part-1)

CTPS Course Teaching Team

Discussion Topic

UNDERSTANDING THE PROBLEM



HOW TO SOLVE PROBLEMS

SELECT AND USE INFORMATION

DATA PROCESSING

Process Analysis of Making a Cup of Instant Coffee

1. Prepare all tools and materials (cup, spoon, kettle, coffee, water and sugar)
2. Fill the kettle with water and boil it
3. Put the coffee and sugar into the cup using a spoon
4. Pour boiling water into a cup
5. Mix well using a spoon
6. Clean and store all used items

Complicated but we do everyday without thinking and planning

Process Analysis of Putting Small Packages Into Big Cardboards

Method 1: Measure large boxes and small packages, then count to get the best arrangement

Method 2: Try and try until all the small packages can fit into the big box

Need strategy

What is that problem?

A problem is a situation where we need to find a solution from a set of conditions

A problem consists of a collection of information and a question to answer

Strategy

Thinking

Planning

What is needed to solve the problem?

Strategy, Thinking, and Planning

- Is a method for carrying out the process can be systematic, logical, mathematical, or may involve trial and error.
- Is a problem solving maker
- Is the essence of problem solving

Problem solving

- Can be the result of a mathematical calculation, namely the number
- It can be a way of doing something

The problem solving tested in the thinking skills test does not ask for formal proof, but rather asks for a solution, which may be a calculated score or a way of doing something

Process In Problem Solving

Identify which pieces of data are relevant from a set of data that are mostly irrelevant

Combining pieces of information that may not be visible, to provide new information

Connects one set of information to another in a different form. This involves using experience (associating a new problem with an old problem we have solved before)

Case study

Luke is having a meeting in a town 50 km away at 3 o'clock tomorrow afternoon. He planned to travel by train, walking to and from the station at both ends.

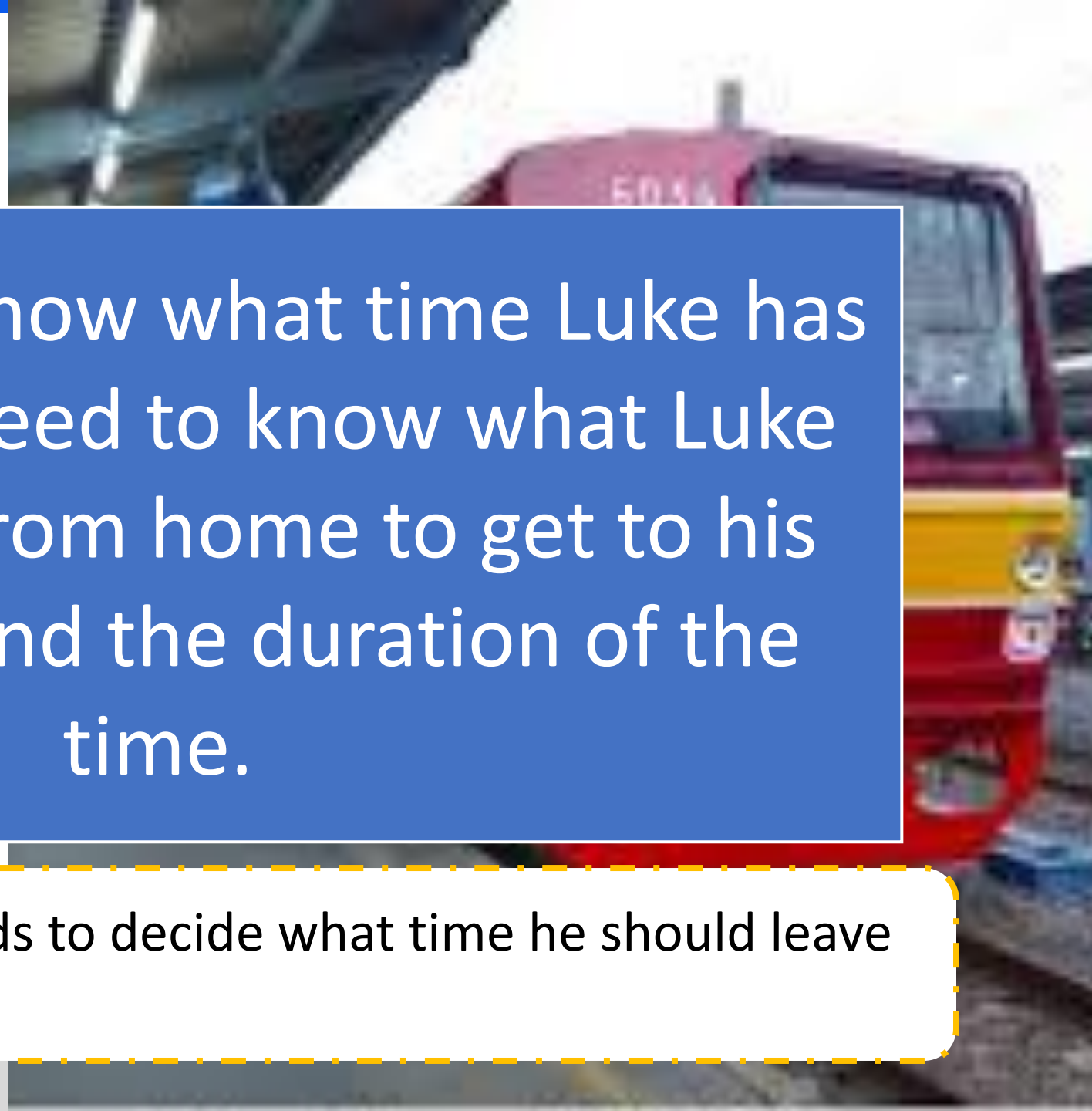
List the information Luke needs to decide what time he should leave the house.

Case study

Luke is
town 5
tomorr
planne
walkin
at both

To be able to know what time Luke has to leave, we need to know what Luke needs to do from home to get to his destination and the duration of the time.

List the information Luke needs to decide what time he should leave the house.



What Luke needs to do:

1. He left his house.
2. He walked to the station.
3. He bought a train ticket.
4. He went to the platform.
5. He was getting on the train when it arrived.
6. He sat in the carriage until it reached its destination.
7. He leaves the carriage.
8.

Information needed:

1. The time it takes to walk from his house to the station.
2. The time it takes to buy a ticket. (Calculate queue)
3. Time to walk to the platform.
4. Train schedule.
5. The time it takes to walk from the station to the meeting place.

If all this information has been obtained then we just have to count down from 3 hours what time Luke has to leave.

How to solve the problem

There is no definite formula for solving problems
Every problem is solved with a different approach

In solving problems

Seeing the situation in a different way

Can use many different strategies

Have an open mind and be prepared to try a different approach

If you have found a solution, then re-evaluate

Evaluation can be used to find solutions again or to solve further problems

Problem Solving Approach

Heuristic

- A systematic, ordered and structured approach
- Usually takes longer

Brute Force

- Find and search method
- Referring to the so-called trial and error
- Usually faster

Problem Solving Approach

Imagine you go out and can't find your house keys.

Problem: How to find house keys???

1. Heuristic method: going around all possible places to see if the key is there. After the possible places, you start looking at the less likely places, and so on until the key is found

2. Brute Force: search every room of the house thoroughly until it is found. This is often the most reliable method but can take a very long time and most people will use it as a last resort.

3. Structured method: using experience, involves careful thinking about when was the last time you came into the house and what was done; this can be the fastest method.

Case study

- Julia had stayed at the hotel on a business trip. When he checked out, the hotel computer was not working, so the receptionist made the bill by hand from the receipt, totaling $471. Julia thought she had been overcharged, so she checked the itemized bill carefully.
- Room: 4 nights for $76.00 per night
- Breakfast: 4 people for $10.00 per person
- Dinner: 3 each for $18.00
- Phone: 10 units for $1.70 per unit
- Bar: a variety of drinks for a total of $23.0
- Laundry: 3 blouses for $5.00 each

It seems the receptionist miscalculated one of the items when adding up the total. What item got Julia overcharged
????

Case study

- Although this example is simple, it illustrates the many methods used in solving the problem:
- Clearly and clearly identify the solution required. It is very important to read the questions carefully and understand them.
- View available data. Identify which sections are relevant and which are irrelevant.
- Do you need to make one or more intermediate calculations before you can reach the answer? It can define strategies for solving problems.
- You may need to search the data provided for a piece of information that solves (or helps solve) the problem.
- Past experience of similar problems helps.

If you've never seen a problem like this before, you should spend more time understanding it.

The above problems are solved by a systematic procedure

Case study

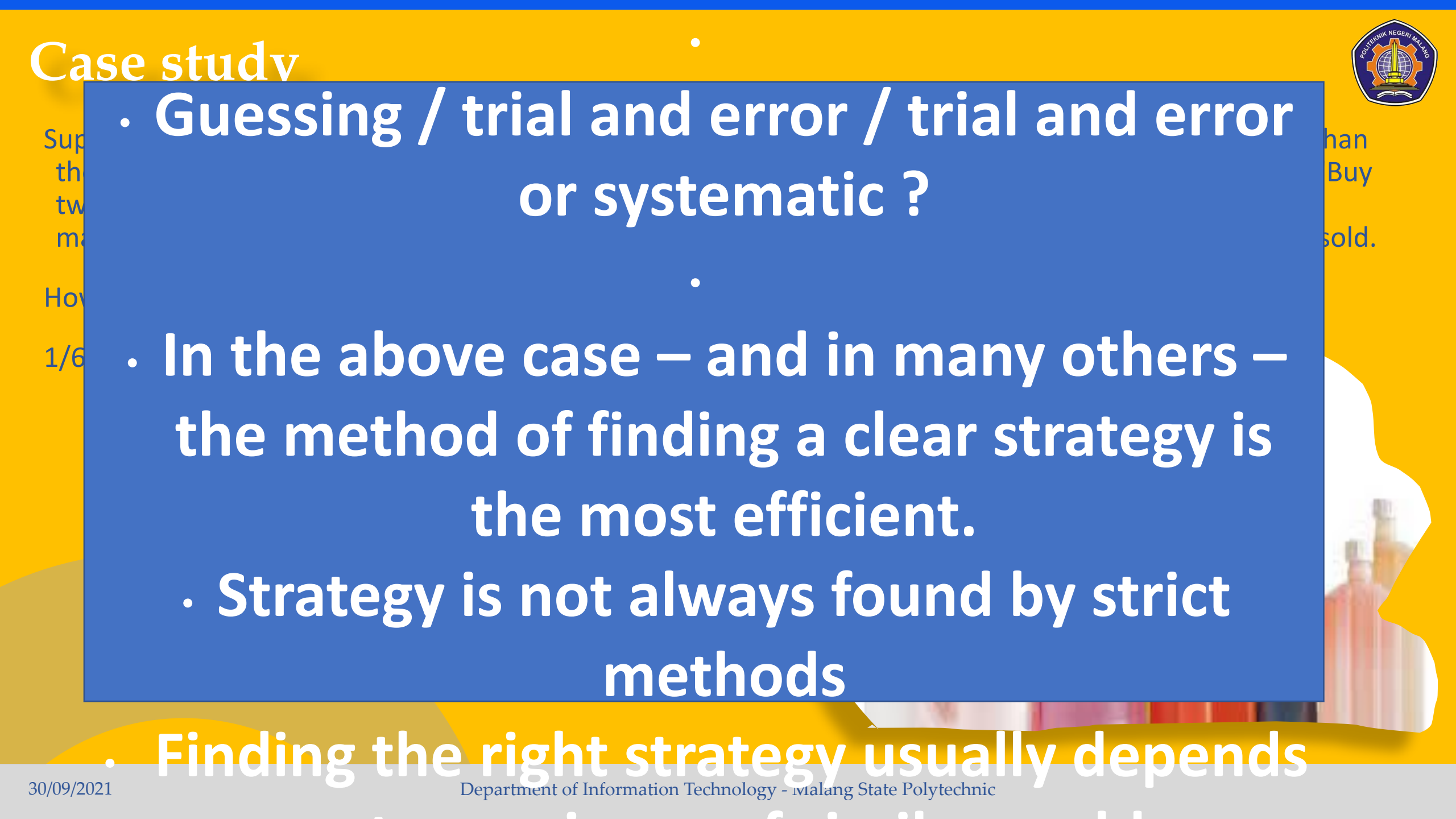
SuperSave SuperSave sells Sudsy cleaning fluid for $1.20 per bottle. At this price they charge 50% more than the price at which they purchased the goods from the manufacturer. Next week SuperSave is holding a 'Buy two free third' offer for this item. Supermarkets don't want to lose money on this offer, so expect manufacturers to lower their prices so SuperSave will get the same actual profit on every three bottles sold.

How much should producers reduce their prices?

1/6 B. 1/4 C. 1/3 D. 1/2 E. 2/3

Case study

- Guessing / trial and error / trial and error or systematic ?
- In the above case – and in many others – the method of finding a clear strategy is the most efficient.
- Strategy is not always found by strict methods
- Finding the right strategy usually depends



Selecting and information

- In one very simple form, problem solving involves understanding and using information.
- To solve a problem it is necessary to select the correct pieces of information and use them in the right way.
- Information can come in many forms and, if you want to be good at using it, you need to practice extracting data from a variety of sources

Information Form

Tabel	include a survey summary, specification sheet or transportation schedule.
Grafik	used in science and business to provide information in such a way that it can be absorbed quickly and easily. For example, a graph can show variables such as temperature over time; Financial data can be displayed in a bar chart.
Kata-kata	numerical, spatial, logical and many other types of information can be summarized or described in words.
Gambar	Drawings, for example in the form of drawings of engineers or architects, can be used not only to show something looks like, but also to provide information about its relative size and position.
Diagram	diagrams in various forms: flowcharts, maps, schedules, decision trees and many other types can summarize numerical and spatial information

Case study

The table to the right shows the results of a survey on participation in three types of regular exercise by people of three age groups.

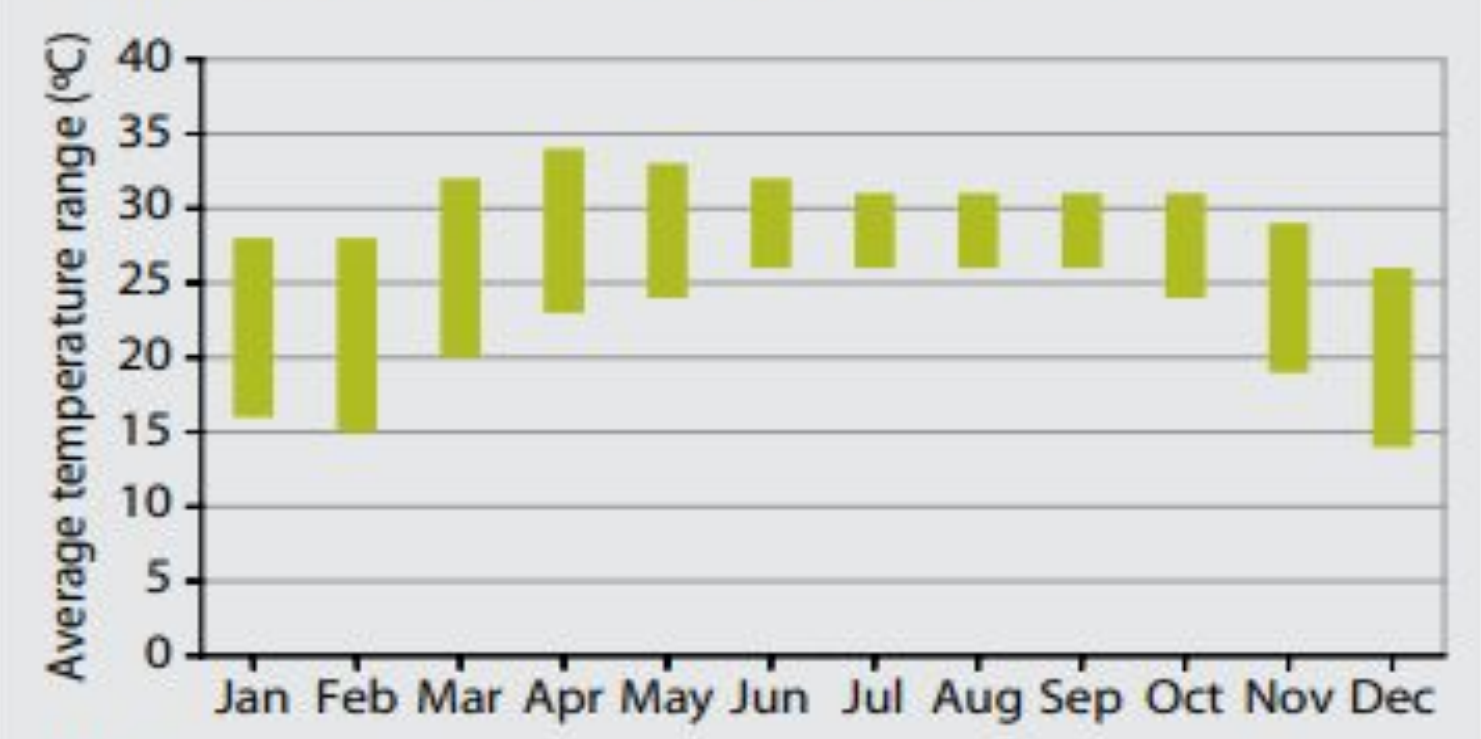
The row and column totals are correct, one of the individual numbers in the table has been typed incorrectly. Which one????

Age	Type of exercise			
	Gym	Swimming	Jogging	Total
10–15	14	57	32	103
16–20	86	92	45	232
21–25	67	58	44	169
Total	167	207	130	504

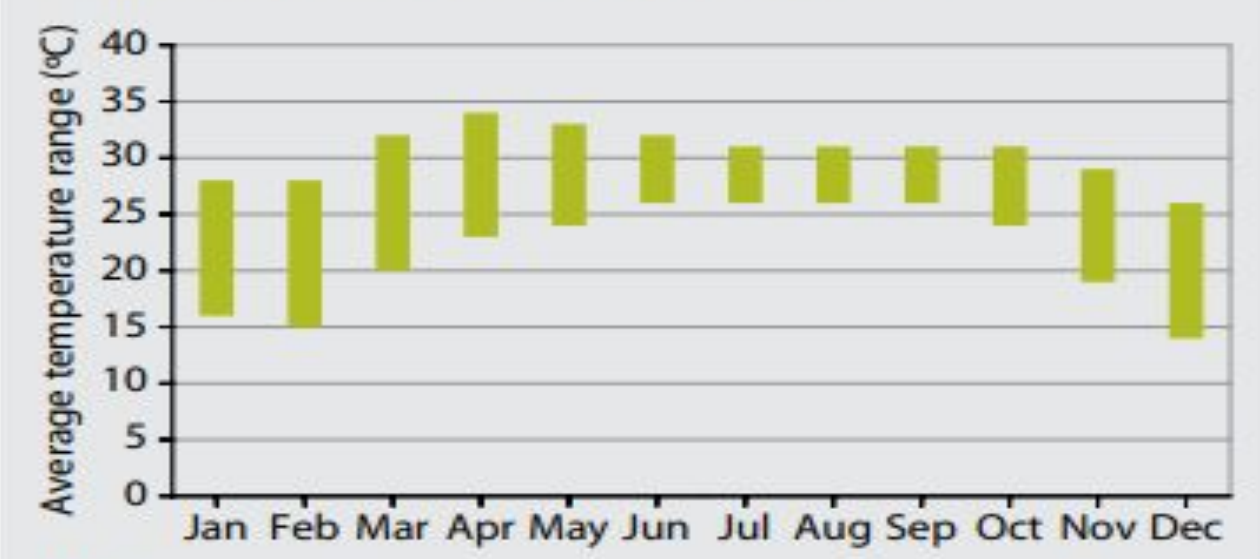
What information do we have?

Case study

- The graph shows the monthly average temperatures for Bangladesh. The lower end of the bar shows the lowest average daily temperature during the month and the upper end of the bar shows the highest average daily temperature during the month
- What is the difference between the lowest average temperature and the highest average temperature throughout the year?



Case Study Completion



There are two skills involved here. First we must understand the verbal description of what the graph means. Then, based on the question, one has to interpret the chart in the required way.

The solution is quite simple and involves subtracting the lowest point on one of the bars from the highest point on one of the bars. These values (read as accurately as possible) are 14° and 34°, so the total range is 20°.

Processing Data

Associated with
how to use data
in the right way
to solve the problem

Case study

Luiz and Bianca are brothers and attend the same school. Luiz walks to school using a path, a distance of 900 m, and he walks at a speed of 1.5 m/s. Bianca cycles to school all the way, a distance of 1.5 km, and she cycles at a speed of 5 m/s. They both planned to arrive at school at 8.55am. Who left the house first and for how long?

A. Bianca, 5 menit

B. Luiz, 5 menit

C. Mereka pergi pada waktu yang sama

D. Bianca, 10 menit

E. Luiz, 10 menit lagi

Case Study Completion

- The skill in this question is to use the right information correctly and at the right time in calculations.
- There are five relevant pieces of data (two distances, two speeds and the fact that they arrived at the same time). It's pretty obvious that the solution method is to calculate each trip time, so in this case there's no method to find it.

- Luiz walks 900 m at 1.5 m/s, so this takes 900:1.5 = 600 seconds or 10 minutes.
- Bianca cycles 1.5 km (1500 m) at a speed of 5 m/s, which takes 1500:5 = 300 seconds or 5 minutes.
- Since Luiz needs 5 more minutes, he has to leave the house 5 minutes early, so B is right.

Case study

- Cheng has a garden pond. At the beginning of each week, Cheng fills the pool as much as 60 liters taken from the water reservoir. The water reservoir is initially filled with 200 liters of water, and then filled with rain water. The average weekly summer rainfall where he lives is 5 mm. The water reservoir to fill the pool has an area of 6 m2.
- For how many weeks did Cheng expect to have enough water in the reservoir to fill the pond completely?

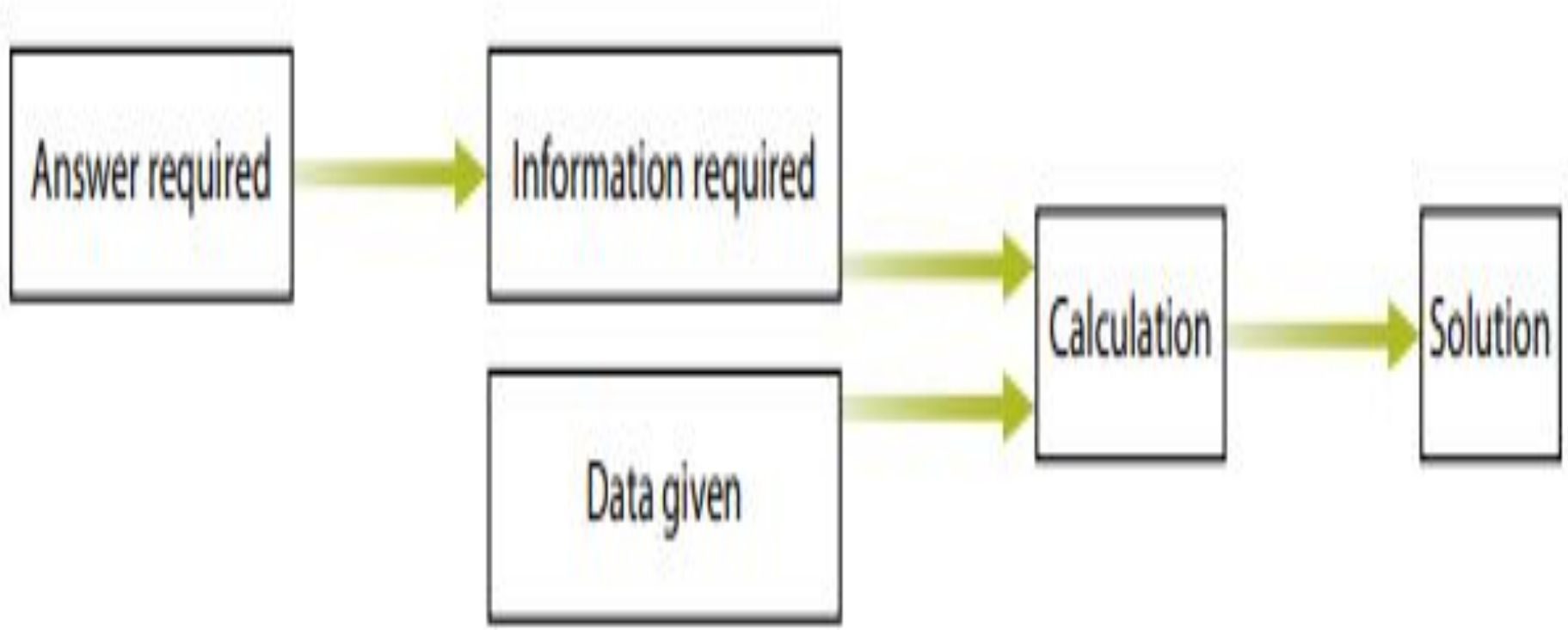
Case Study Completion

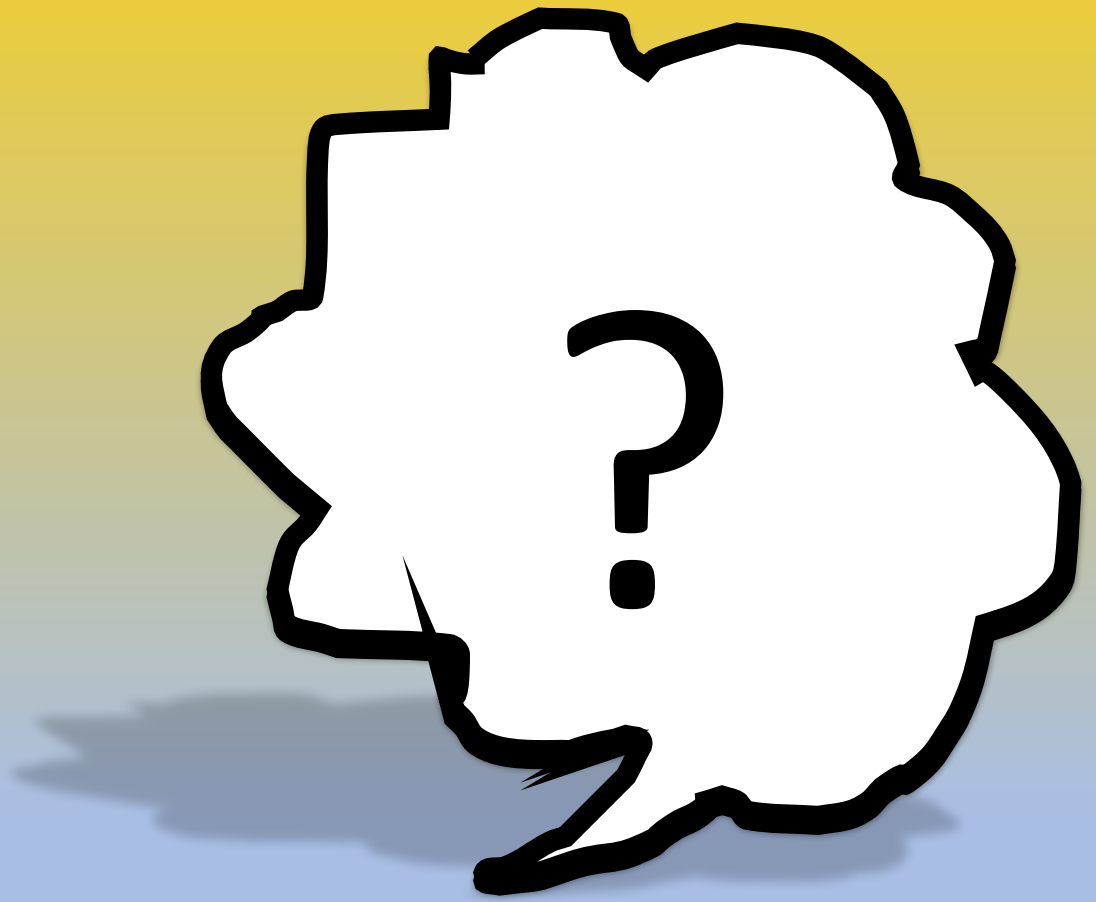
This question has a lot of data presented verbally. We must identify the important variables to be calculated to answer the question.

This is done by working backwards, we need the number of weeks the water in the reservoir will last. This, in turn, depends on the amount of water in the reservoir at the outset (already known) and the average water loss per week. The average water loss per week is the amount collected minus the amount used (which we also know). So, the only thing that is unknown is the amount collected. This is what we have to calculate first.

- Weekly rainfall is 5 mm, which is collected in a 6 m2 storage tank. In consistent units (using meters) the volume collected is 6 m2 × 0.005 m of rain or 0.03 cubic meters. One cubic meter is 1000 liters, so the collected volume is 30 liters.
- Because Cheng uses 60 liters per week and collects 30 liters, he loses 30 liters net every week. So the water in the 200 liter tank will last for 5 weeks; at the start of the sixth he will have only 50 liters, which is not enough to fill his pond.

Problem Solving Approach Method






Thank You!

Task

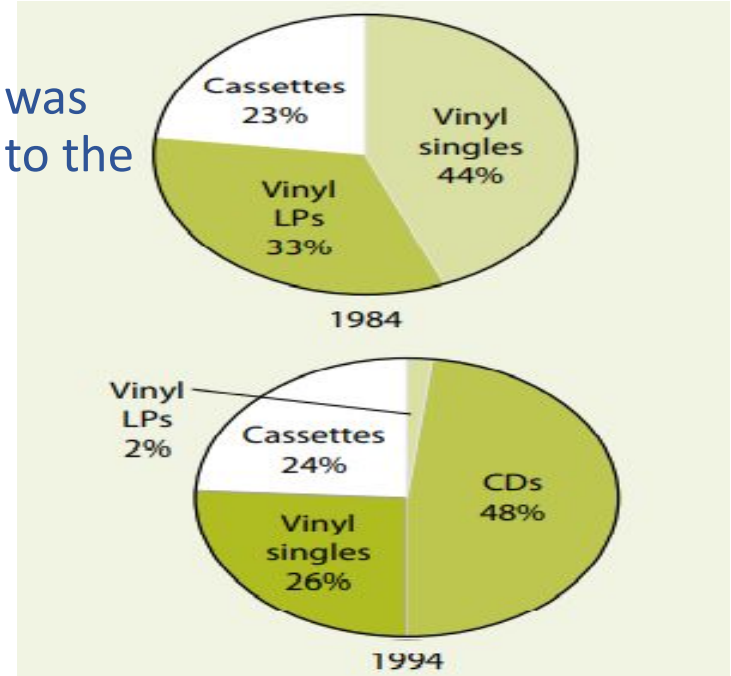
Consider something you might want to buy, such as a car, cell phone, or computer. List the information you need to make a decision about the model or models to buy.

The gasoline use of a number of cars has been measured. Each car starts with a full tank, then travels (all travels on the same road). After the trip the tank is refilled, the amount of gasoline needed to fill it is recorded. The results are shown below. Sort the car's fuel efficiency (km/liter), from lowest to highest.

Car	Length of journey (km)	Petrol used (litres)
Montevideo	120	10
Stella	150	16
Riviera	200	25
Roamer	185	21
Carousel	230	16

Task

The pie chart beside illustrates the changing introduction of CDs in 1985 in the recorded music market. The total annual sales of all types of records in 1984 was 170 million and in 1994 they were 234 million. What do you think happened to the actual annual sales of vinyl singles between 1984 and 1994?



A They are down 14 million.

B They are down 5 million.

C They don't change.

D They went up 17 million.

E They went up by 64 million.

A pancake stall selling sweet pancakes and savory pancakes. Savory pancakes can have three toppings (eggs, ham, tomatoes) that can be used in any combination. Sweet ones come with marmalade, lemon or strawberry with ice cream or fresh cream. How many combinations does the kiosk sell?