

McKinsey & Company

McKinsey Problem Solving Test

Practice Test C

McKinsey Problem Solving Test – Practice Test C

Practice Test Overview and Instructions

This practice test has been developed to provide a sample of the actual McKinsey Problem Solving Test used for selection purposes. This test assesses your ability to solve business problems using deductive, inductive, and quantitative reasoning. This practice test contains a total of 26 questions. The actual test contains 26 questions and you will be given 60 minutes to answer as many questions as possible.

You will be presented with three scenarios based on actual McKinsey client cases. Information related to each scenario will be shown in text, tables, and exhibits. This information is presented in double-bordered areas and is distributed in sections throughout the scenario. The questions ask you to find the most appropriate answer to the problem as described using only the information presented. You should select one and only one answer to any question.

While completing this practice test, do not use any electronic devices (e.g., calculator, computer) when performing calculations to answer the questions. Electronic devices will not be permitted to be used during the actual test administration. Also during the actual test administration, you may use all blank space in the test booklet as scratch paper to assist you in performing any calculations and recording any notes. No scratch paper will be allowed. Booklets will be destroyed after you complete the test and will not be used in any way to determine your test scores. Your final test score will be based on the number of questions you answer correctly.

The practice scenarios begin on the next page of this booklet. Only consider information contained within the scenario when determining your answer. Considering all information presented within the scenario is critical to answering questions correctly.

After you have completed the test, score your answers using the answer key located at the end of this booklet. Add the number of correct answers to determine your final total score.

PLEASE GO ON TO THE NEXT PAGE

Mail-It

Mail-It is a company that runs postal services for both personal and business customers in the country of Molvania. The postal services that *Mail-It* provides cover all areas from collection to delivery. The main stages of operating a postal service are as follows:

- **Retailing postal fees:** The customer pays *Mail-It* for the cost of sending a letter or package. For a personal customer, this service is often completed by the customer purchasing stamps at *Mail-It* post offices. For larger business customers, this can be completed via the automated stamping of their mail. The price of sending a letter or package depends on its destination, its weight, and the required speed of its delivery. For business customers, the price is usually cheaper because they often use automated stamping and often bring the mail to *Mail-It* themselves.
- **Collection:** *Mail-It* collects the stamped mail from designated post boxes. Customers deposit the majority of this mail into the designated post boxes. However, some business customers may take their mail directly to *Mail-It*'s sorting offices.
- **Sorting and stamp cancellation:** *Mail-It* sorts the mail according to the destination. This sorting usually happens at designated offices nationwide. Most domestic mail has an address code written by the sender which can be read and sorted automatically by machines. When mail is sent without a code or the machine cannot read the code, the sorting must be done by hand. At this stage, the stamp on the letter or package is also "cancelled" using an ink mark to ensure that the stamp cannot be re-used.
- **Transportation and delivery:** Once the mail has been sorted, it is transported to the area to be delivered, using a combination of road, rail, and air transport. The local delivery offices then proceed to deliver the mail to the designated address.

The CEO of *Mail-It* noticed that the profitability of the business during the month of December was significantly lower than other months. He has asked a McKinsey team to investigate the possible reasons for this, as well as to suggest possible remedial measures. The CEO tells the team that he is puzzled about this finding.

He adds that Molvania is a predominantly Christian country and celebrates an extended Christmas holiday period in the latter part of December. He also informs the team that quantities of personal mail increase during this month due to the customary tradition of sending Christmas greeting messages and cards. In light of these facts, the CEO cannot reconcile the lower profitability in December. Table 1 shows some key financial data for *Mail-It*, comparing the average data for December with the average data for the other eleven months of the year.

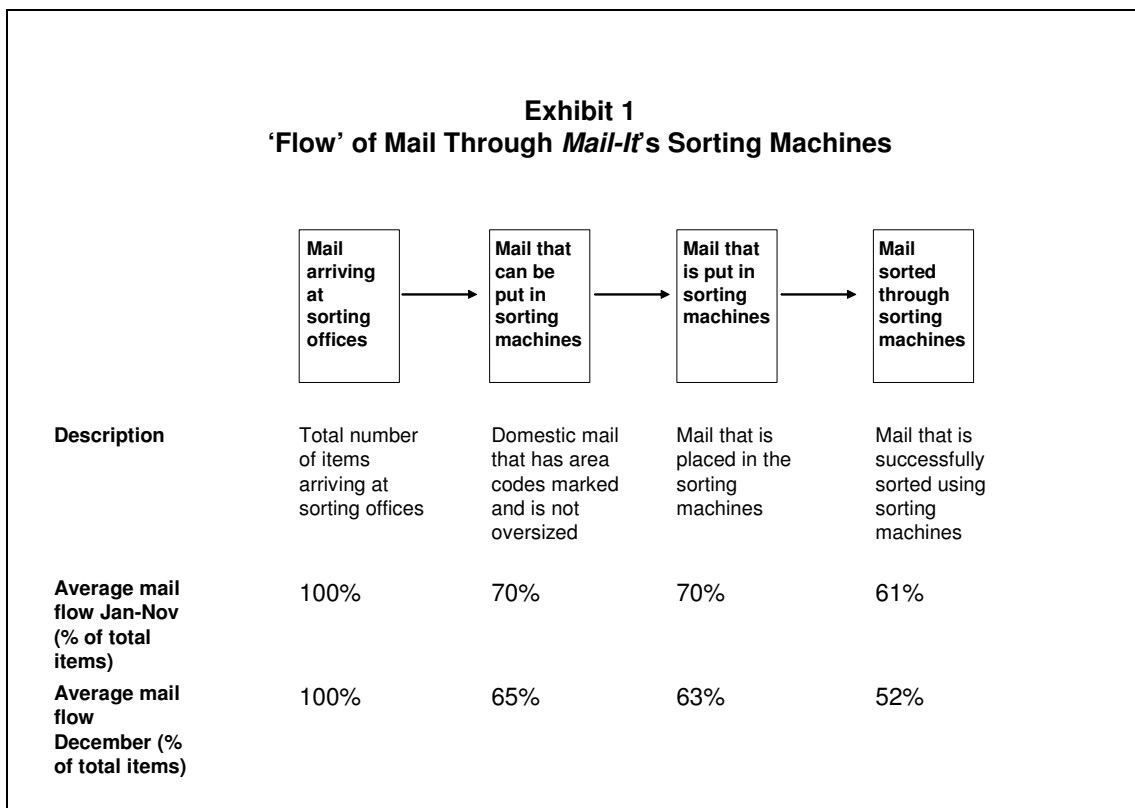
	January – November	December
Number of days in month	30.4	31.0
Revenue (\$US millions)	246.2	266.1
Number of items handled (millions)	991.0	963.0
Costs (\$US millions)	212.3	251.2
Profit (\$US millions)	33.9	14.9

- Which of the following statements, if true, would best explain the differences in the revenue and number of items handled between December and the other months of the year?
 - There is a greater proportion of personal mail sent in December than at other times of the year
 - There is a greater proportion of business mail sent in December than at other times of the year
 - The average weight of items in December is lower than it is at other times of the year
 - Customers do not send as much urgent mail in December as they do at other times of the year
- What is the difference, in percentage points, between the profit margin for December versus the average profit margin for the other months?
 - 3.7 percentage points
 - 5.2 percentage points
 - 6.7 percentage points
 - 8.2 percentage points

PLEASE GO ON TO THE NEXT PAGE

3. Which of the following statements is most accurate regarding the data in Table 1?
- A) There are approximately 3% less items per day in December versus the average of the other months of the year
 - B) There are approximately 5% less items per day in December versus the average of the other months of the year
 - C) There are approximately 3% more items per day in December than in any of the other months of the year
 - D) There are approximately 5% more items per day in December than in any of the other months of the year

The team proceeds to examine various factors related to *Mail-It's* business operations. One of the factors the team looks into is the sorting of mail by machines, which are located in the sorting offices. These sorting machines use red lasers to read the address code written or printed on the letter or package. Once the machine reads the address code, the letter or package is routed to the appropriate area for distribution. If the machine cannot read the address code, it is rejected and must be read and sorted by hand. Exhibit 1 shows the "flow" of mail through *Mail-It's* sorting offices and how it differs in December versus the rest of the year.



4. Which of the following reasons, if true, would best explain the differences in the data identified as “Mail that can be put in sorting machines”?
- A) People send more mail to old friends in December and do not know their address codes
 - B) A lot more personal mail is sent with handwritten addresses in December, which are more difficult for machines to read
 - C) More sorting machines develop faults and break down in December
 - D) More domestic mail is sent in December because of the Christmas greeting card surge
5. How many more items of mail need to be hand sorted in December versus the average of the other months of the year?
- A) 76 million
 - B) 104 million
 - C) 132 million
 - D) 160 million
6. Which of the following ideas would NOT help address the differences in the mail flow between December and the remainder of the year as indicated in Exhibit 1?
- A) Work with Christmas greeting card manufacturers to add instructions to envelopes informing the sender to write the address clearly
 - B) Discourage the production of red envelopes for Christmas greeting cards, which cannot be read using red laser beams
 - C) Discourage the production and retail of very large novelty Christmas greeting cards
 - D) Encourage manufacturers to create greetings cards with envelopes that have pre-paid postage

While discussing the topic of mail sorting, the CEO of *Mail-It* wonders about the necessity of cancelling the stamps on manually processed mail. While stamp cancellation is done automatically for machine-readable mail, it is a manual process for mail unable to be read by the machine. This task takes up a high proportion of staff time during the busiest time of year and therefore overburdens employees. Thus, he wonders if the benefits of cancelling this step of the process outweigh the risks.

7. Which of the following questions best summarizes the CEO's concerns?
- A) Does stamp cancellation take up too much unnecessary time in the processing of manual mail?
 - B) Would the gain in productivity from stopping stamp cancellation in manual mail be worth more than the lost revenue from fraudulent re-use of stamps?
 - C) Would the amount of time saved from stopping manual stamp cancellation result in a significant decrease in the time spent processing manual mail?
 - D) Does it make sense to stop the cancellation of stamps on manual mail given that the majority of mail now goes through machines?

The team also investigates staffing costs in sorting offices in December versus the remainder of the year. Table 2 shows some measures of staff cost and staff productivity in sorting offices, comparing the data for December with that of the remainder of the year.

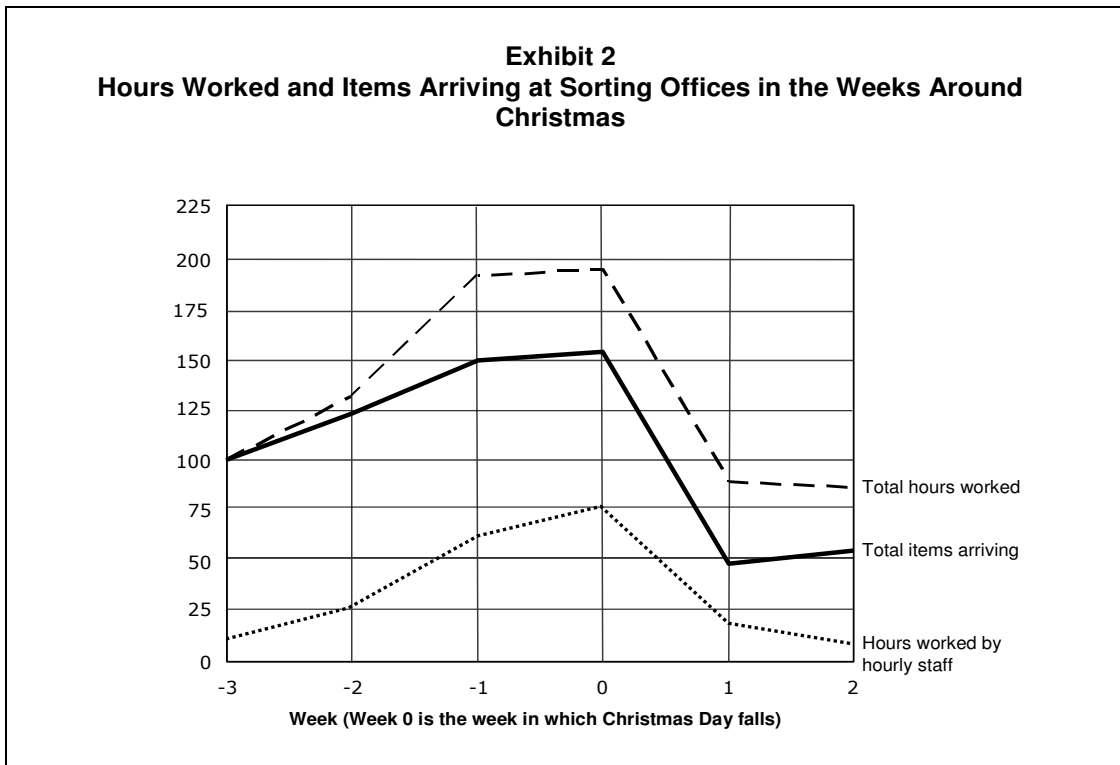
	January to November	December
Hourly rate of pay (p)	\$8.20	\$7.60
Items handled (h)	991 million	963 million
Paid hours spent working (w)	8.1 million	9.4 million
Paid hours spent not working (e.g., sickness, training) (n)	1.9 million	1.2 million

8. Which of the following reasons, if true, would best explain the differences in Paid Hours spent NOT working between December and the average for the rest of the year?
- A) More hourly staff are employed in December and they are paid per hour spent working
 - B) More holidays are taken by employees in December because of the Christmas period
 - C) More sick days are taken by employees in December because of the cold weather
 - D) More items are handled overall from January to November versus December

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9. Which of the following statements would NOT be a potential reason for the lower rate of items handled per hour spent working in December?
- A) The staffing of the different sorting offices is more chaotic in December and is not aligned with the volume of mail expected in each office
 - B) Staff performance reviews take place in November and their productivity bonuses for the year have already been decided by the beginning of December
 - C) Staff spend less hours working in the last week of December, immediately after the Christmas holiday
 - D) In the last week in December, immediately after the Christmas holiday, there is 40% less mail to be handled than in the rest of the year
10. If an average employee is paid for 160 hours per month, which of the following formulae accurately calculates the average number of items handled per employee, per month, for the periods being investigated?
- A) $h/((w+n) \times 160 \times p)$
 - B) $h/((w+n) \times 160)$
 - C) $(w+n) \times 160/h$
 - D) $(h \times 160)/(w+n)$
11. The CEO of *Mail-It* has traditionally used “Average total pay per item handled” as the key measure of staff productivity for the sorting offices. Which of the following points best explain why this is NOT the ideal measure?
- A) Scoring lower on this measure does not necessarily imply that staff in sorting offices are being more productive
 - B) This measure does not take into account the other costs of operating a sorting office, such as machine costs
 - C) A sorting office can score well on this measure by simply employing a large number of staff
 - D) This measure clearly favours sorting offices with larger amounts of manual mail to handle

The team then proceeds to examine staffing in sorting offices in December. Exhibit 2 tracks the total number of items arriving and hours worked in sorting offices nationwide in the three weeks before and two weeks after Christmas. In this Exhibit, Week 0 is the week containing Christmas Day. The solid black line represents the total items arriving, and is given as a percentage of the total items in week -3. The broken line at the top represents the total hours worked, and is given as a percentage of the total hours worked in week -3. Finally, the dotted line at the bottom represents the hours worked by hourly staff who are not permanent employees of *Mail-It*, and is given as a percentage of total hours worked in week -3.



12. Which of the following statements is a valid conclusion of the weeks being analysed from Exhibit 2?

- A) Week -1 saw the highest proportion of time worked by hourly staff compared to other staff
- B) In Week -3, the hours worked were exactly enough to match the number of items received
- C) Between Weeks 1 and 2, the change in total hours worked was not proportional to the change in items arriving
- D) Between Weeks -2 and -1, the increase in hours worked by hourly staff was not enough to cover the increase in items received

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National Garbage Inc

National Garbage Inc (NGI) is a company that runs garbage disposal services in all major cities across the United States. *NGI* provides two types of garbage disposal services:

- **Trash collection:** *NGI* runs a fleet of trucks that collects garbage from businesses along various routes in a city and transports it to a landfill site that is either owned and operated by *NGI* or another operator. *NGI* runs this service in every major US city.
- **Landfill management:** *NGI* owns landfill sites in some of the cities where it operates trash collection services. These sites receive the garbage from both *NGI* garbage trucks and those of other operators. The waste is then processed and disposed of at these sites (mainly by burying it).

NGI's operation in each city is managed as its own company, and provides reports to the *NGI* head office in Boston. *NGI's* trash collection service is paid for by their customers (various sized businesses) on a monthly basis. The monthly fee depends on the volume of trash to be handled and ensures two collections per week from the customers' premises. It also covers the cost of handling the waste on the landfill site where it is deposited.

On landfill sites that it owns and operates, *NGI* makes additional revenue through charging non-*NGI* garbage trucks a fee per ton of waste handled. Fees for both trash collection and landfill management services can differ by city due to the varying intensity of local competition.

NGI has found that there is considerable variation in the performance of its companies in the various cities. Table 1 shows some important data for three cities where *NGI* runs both trash collection and landfill management operations:

	Milwaukee	San Diego	Orlando
Average trash collection fee per customer per month (<i>t</i>)	\$420	\$370	\$400
Number of trash collection customers (<i>n</i>)	10,000	13,000	11,500
Landfill fee to non-<i>NGI</i> trucks per ton of waste (<i>l</i>)	\$25	\$30	\$22
Total waste processed at landfill site per week (<i>w</i>)	5,000 tons	4,200 tons	6,800 tons
Net profit margin (trash collection)	6%	9%	2%
Net profit margin (landfill mgmt)	15%	18%	12%

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A new CEO has recently been appointed at *NGI*. He has asked McKinsey to perform a review of the business to determine the key causes of the variability in performance across the cities. He would also like the team to investigate the best performing cities in order to build recommendations on how to improve profitability in the underperforming cities.

13. Which of the following equations best approximates *NGI*'s weekly revenue, r , in a city?
- A) $r < t \times n + l \times w$
- B) $r = t \times n + l \times w$
- C) $r < (t \times n) / 4 + l \times w$
- D) $r = (t \times n) / 4 + l \times w$
14. Based on the data presented in Table 1, which of the following statements is a valid conclusion?
- A) Trash collection contributes approximately 25% less towards overall profit than landfill management in these three cities
- B) San Diego has the lowest revenue from trash collection operations of the three cities
- C) Orlando has the highest revenue from landfill management operations of the three cities
- D) In these three cities, landfill management brings in two to six times more profit per customer dollar spent than trash collection
15. Which of the following statements, if true, would NOT help explain the differences in net profit margins for trash collection across the three cities in Table 1?
- A) Different cities require different staffing levels due to complexities of collection routes
- B) Price competition for trash collection services differ by city
- C) There are differing levels in the average volume of trash per customer in the different cities
- D) There are differing levels in the average fuel cost per transport in the different cities

The team proceeds to analyse the average profitability of a garbage truck. They gather the following information regarding a typical garbage truck in Orlando:

- The average weekly fee per customer is \$100
- Customers get two pickups per week, each weighing 0.1 tons per customer on average
- Truck, fuel, and crews cost \$2,000 per day and operate five days per week
- The cost to *NGI* trucks of disposing at *NGI*'s landfill site is \$15 per ton

16. Assuming no costs other than those mentioned above, which of the following quantities represent the SMALLEST number of customers required for an Orlando garbage truck to make a profit on its weekly run?
- A) 96
 - B) 100
 - C) 104
 - D) 108

In an effort to investigate ways in which *NGI* could increase its number of trash collection customers, the team analysed the results of a recent survey on selected businesses located on *NGI* trash collection routes in Orlando. The survey asked questions about the businesses' awareness of *NGI* services and whether they had used *NGI* services before. The results were split between small businesses (employing 50 people or less) and large businesses as presented in Table 2.

	Small Businesses	Large Businesses
Total number surveyed	10,240	2,865
Those aware of <i>NGI</i>'s services	6,983	1,355
Those who have considered using <i>NGI</i> for trash disposal	4,745	1,203
Those who currently use or have used <i>NGI</i>'s trash disposal services in the past	4,295	1,141
Those who currently use <i>NGI</i>'s trash disposal services	2,045	565

17. What is the difference, in percentage points, between the awareness rate of small businesses on these routes and that of large businesses regarding *NGI*'s services?
- A) 1 percentage point
 - B) 4 percentage points
 - C) 21 percentage points
 - D) 26 percentage points

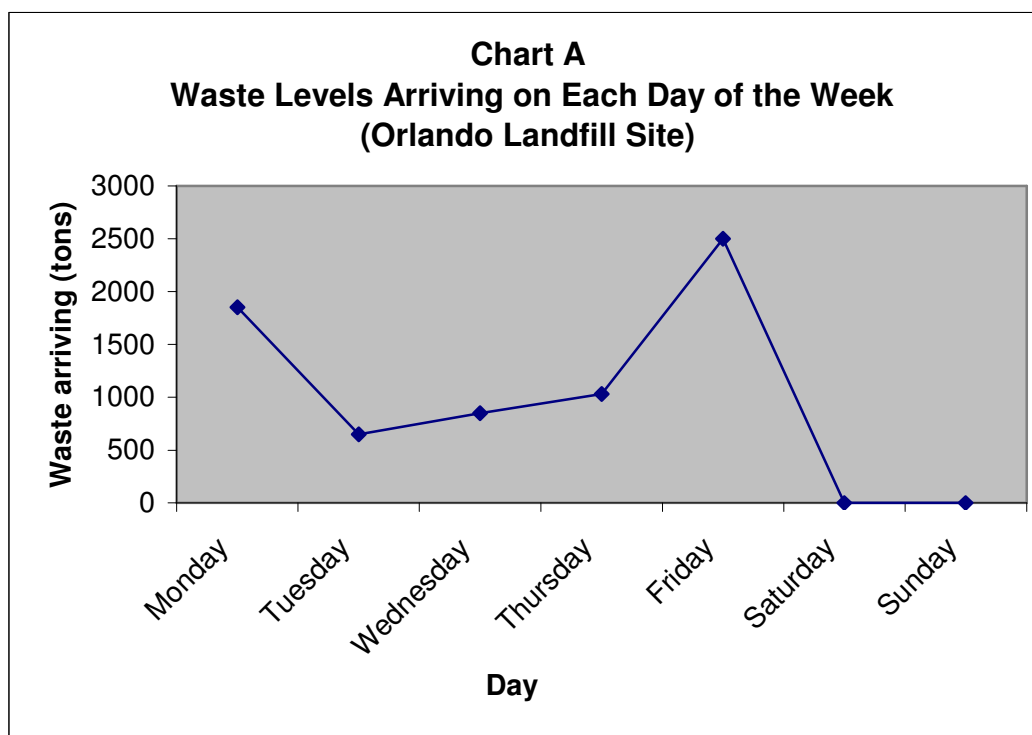
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18. Which of the following reasons, if true, would NOT help explain why the number of current large business customers in Table 2 is smaller than the number of current small business customers?
- A) There are fewer large businesses than small businesses in Orlando
 - B) Large businesses are more likely to have their own waste disposal facilities than small businesses
 - C) Large businesses receive greater levels of advertising and marketing than small businesses
 - D) Waste disposal represents a lower proportion of overall spending for large businesses than for small businesses

The team then investigates the profitability of running landfill sites for *NGI*. During a discussion with the manager of the Orlando company, you find out the following facts:

- Landfill sites must have at least one environmental specialist 24 hours a day, seven days a week, to satisfy environmental regulations
- The *NGI* landfill site in Orlando is the only such site in the city, and is open 9am to 5pm Monday to Friday. It employs four environmental specialists and eight other staff
- Total weekly employee cost for the Orlando landfill site is \$7,000

The manager also gives you Chart A, which shows the amount of trash, in tons, arriving at the landfill site on average each day.



PLEASE GO ON TO THE NEXT PAGE

19. Which of the following quantities best approximates the average daily amount of waste arriving at the landfill site from Monday to Friday?
- A) 985 tons
 - B) 1,095 tons
 - C) 1,375 tons
 - D) 2,175 tons
20. Based on the information provided by the Orlando manager regarding staffing at the Orlando landfill site, which of the following statements is a valid conclusion?
- A) One third of total employee cost for the landfill site is for environmental specialists
 - B) At least one environmental specialist must work more than 40 hours per week
 - C) Staff who are not environmental specialists do not work more than 40 hours per week
 - D) The majority of the landfill site's employee cost is for staff who are not environmental specialists
21. Which of the following values best approximates the employee cost per ton of waste for the Orlando landfill site?
- A) \$0.82
 - B) \$1.02
 - C) \$1.22
 - D) \$1.32

InCo

InCo is a commercial insurance company. The company engages in three activities as follows:

- 1. Underwriting:** This is the main activity of the company. It offers insurance policies to business of all sizes and types, which protect against most risks for these businesses (e.g., fire, theft, liability). It receives regular payments from clients in return for the insurance policies provided to them, and this revenue is known as *premium income*. The *underwriting costs* that *InCo* has include claims (i.e., when a client requests reimbursement for damage or loss under their policy) and operations (e.g., general administration, sales and marketing). The difference between the premium income and the underwriting costs is known as the *underwriting profit*. *InCo* sells the majority of its insurance policies through insurance brokers, who are independent sales agents offering a wide range of policies from many different insurance companies.
- 2. Investment:** Insurance companies usually hold large sums of money aside to cover potential future claims from their clients. Rather than simply leaving the money alone, *InCo* invests the money in the markets to try to make further revenue. This revenue is known as *investment income*. The difference between the investment income and any associated costs (e.g., investment charges) is known as the *investment profit*.
- 3. Risk consulting:** *InCo* offers a small consulting and advice service to large clients to help them reduce their overall business risk in return for a fee.

Over the last 3 years, *InCo*'s underwriting profit has been declining. Last year, *InCo* had a premium income of \$700 million. Its claims cost represented 83% of premium income and its operations cost represented 20% of premium income. Therefore, *InCo* experienced an underwriting loss. Last year's investment profit more than compensated for the underwriting loss. However, the investment profit also declined and is expected to decline further due to low interest rates and weak stock markets.

The CEO of *InCo* asks McKinsey to help him determine how *InCo* could improve its profits. In the first meeting, he informs you that he believes that little can be done to improve investment profit. The cost of underwriting operations seems to have increased over the last few years and claims cost has increased in line with premium income. He also states that the main idea of having a risk consulting business is not to make additional profits via earning fees, but to realise considerable indirect mutual benefits for *InCo* and its clients.

22. Assuming claims cost remained at 83% of premium income and operations cost remain unchanged in \$US millions compared to last year, in order to make an underwriting profit of zero, *InCo* would have to increase premium income by approximately what percentage?

- A) 3%
- B) 12%
- C) 18%
- D) 20%

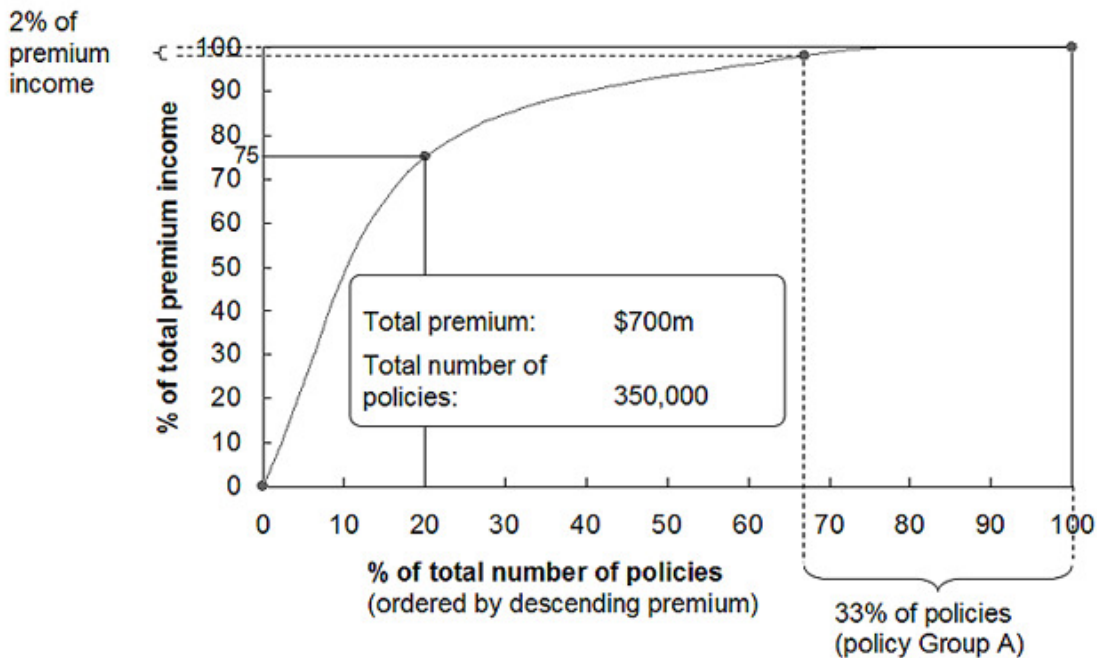
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23. Assuming the relationship between premium income and costs remains the same, which of the following events would have the most positive impact on *InCo*'s profits?

- A) A 1% increase in premium income
- B) A 1% decrease in operations cost
- C) A 1% decrease in claims cost
- D) A 1% decrease in administration cost

Analysing *InCo*'s "book" (i.e., the total of all existing insurance policies), your team first looks at how premium income is distributed over individual policies.

Exhibit 1
Premium Income Distribution Over Policies last year



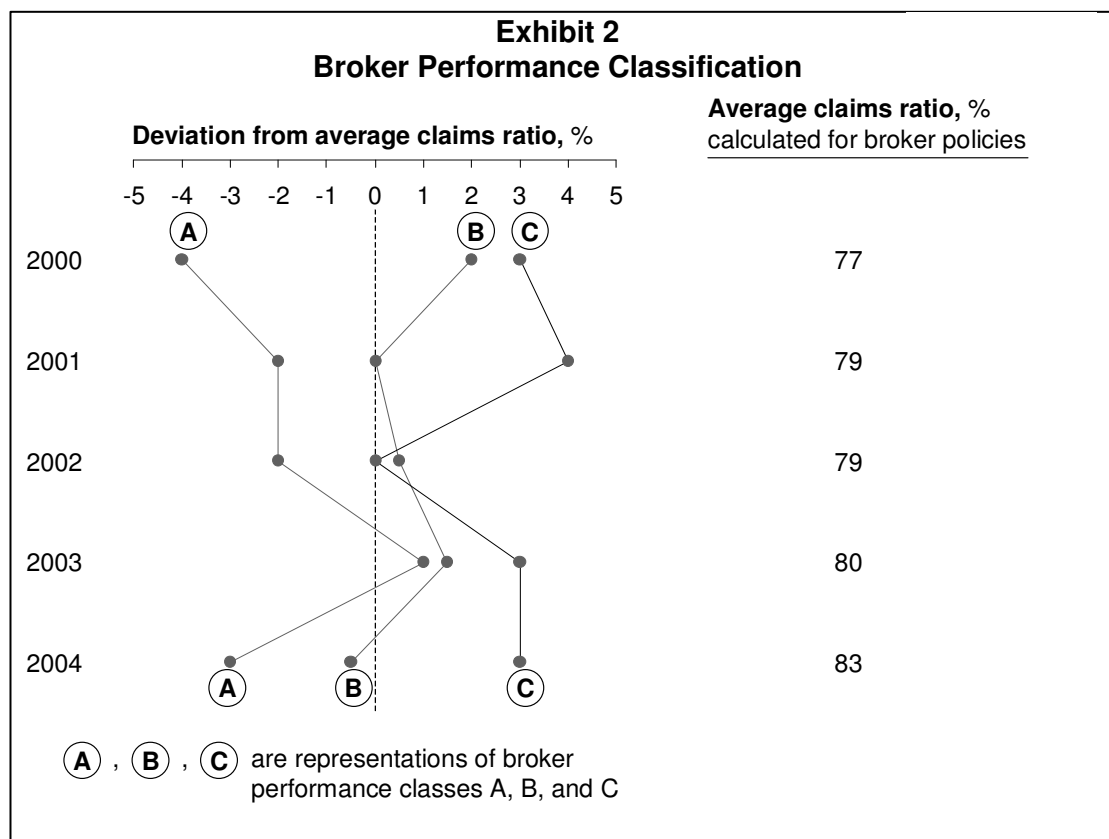
24. Assuming that Group A policies have an average claims cost per policy of \$200, which of the following statements can be concluded from Exhibit 1?

- A) *InCo* makes an average underwriting loss on these 33% of policies
- B) *InCo* makes an underwriting loss on ALL of these 33% of policies
- C) *InCo* should increase premiums for these 33% of policies
- D) *InCo* should stop offering these 33% of policies

PLEASE GO ON TO THE NEXT PAGE

Discussing Exhibit 1 with the head of underwriting, you learn that she had considered cancelling Group A policies. However, in talking to the head of sales she found out that there are strong arguments against doing so. One reason is that large clients who hold several insurance policies with *InCo* might take all of their policies to a competitor if a small premium policy is cancelled. Also, brokers who generate a big portion of *InCo*'s premium income might move to competitors with all of their policies if they cannot place small premium policies with *InCo*.

Since a large portion of *InCo*'s premium income is earned through brokers, the team decides to analyse the profitability of policies sold through each broker. Broker profitability is measured by the *claims ratio*, that is, the claims cost on the policies sold by the broker as a percentage of the premium income earned by the broker. Exhibit 2 shows the performance of three different classes of brokers (marked A, B, and C) on the *InCo* policies they sold over the last 5 years.



PLEASE GO ON TO THE NEXT PAGE

Exhibit 3 shows some data on the share of premium income contributed by each of the three classes of brokers (i.e., A, B, C), as well as the number of brokers in each class and the average claims ratio for each class of brokers.

Exhibit 3
Broker Performance Breakdown 2 years ago

Broker class	% of premium income	Number of brokers	Average claims ratio, %
Class A	26	600	91
Class B	49	300	79
Class C	25	100	71

Total premium from brokers 2 years ago: \$670 million

25. Based on the data presented in Exhibit 3, which of the following statements is a valid conclusion?
- A) The average premium income of Class B brokers is larger than the average premium income of Class C brokers
 - B) The average premium income of Class A and Class C brokers is smaller than the average premium income of Class B brokers
 - C) The average premium income of Class A and Class B brokers is larger than the average premium income of Class C brokers
 - D) The average premium income of Class A brokers is larger than the average premium income of Class B brokers

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Talking to the head of broker relationships, you learn that *InCo* historically classified brokers according to premium growth expectations. He informs the team that personal relationships with brokers can change quickly and have serious consequences. For instance, an upset broker can quickly move his business to one of *InCo*'s competitors. While this hurts *InCo* less with a smaller broker, it can hurt *InCo* significantly with the larger brokers. In addition, *InCo* is already short on people who can maintain their current broker relationships and would not be able to deal with the additional work involved in maintaining these relationships.

26. Which of the following statements, if true, would be the strongest argument for discontinuing business with underperforming brokers?

- A) The majority of *InCo*'s underperforming brokers do more business with other insurers than with *InCo*
- B) Small broker enterprises run by less than 5 people account for most of *InCo*'s underperforming brokers
- C) Most underperforming brokers provide predominantly small premium policies
- D) There are too many underperforming brokers for *InCo* to manage with their current resources

Answer Key

Mail-It

1. **A** – The data in Table 1 indicates that the average price per item increases in December (by dividing the revenue by the number of items handled). As we are told that business mail is usually cheaper than personal mail, an increase in the proportion of personal mail could explain the increase in the average price. The other responses are not consistent with an increase in the average price per item.
2. **D** – Profit margin is profit as a percentage of revenues. In January-November, the average profit margin is 13.8%. In December, it is 5.6%, giving a difference of 8.2 percentage points. A quicker, alternative method is to note that the difference in profit is about \$20m, and that the average revenue for the full year is about \$250m, so that the difference is about $\$20m/\$250m = 2/25 = 8\%$, pointing to D as the likely response.
3. **B** – Average items per day can be derived by dividing the number of items handled by the number of days in the month. This produces 32.6m for January-November and 31.1m for December. The reduction in December as a percentage is therefore $1.5m/32.6m$ which is 4.6%, so that a reduction of about 5% is the most accurate response. A quicker, alternative method is to note that Responses C and D cannot be correct as they indicate that average items handled per day *increased* in December. This leaves a choice between Responses A and B. Observe that items handled went *down* by about 3%, and number of days went *up* by about 2%. The combined impact of these changes would be an increase of about $3 + 2 = 5\%$ which indicates Response B to be the most accurate response.
4. **A** – The only valid reasons for an item not being eligible for machine sorting are a lack of address code or an inappropriate size (From Exhibit 1). Only Response A provides one of these reasons, which is consistent with the reduction in December that is indicated on Exhibit 1. Response B would impact step 4 in the flow chart in Exhibit 1. Response C would impact step 3. Response D would impact step 1.
5. **A** – From Exhibit 1, 39% of mail needs to be sorted by hand in January-November. Given that there are 991m total items on average in these months, this means 386m items are sorted by hand. A similar calculation yields a figure of 462m for December ($= 48\% \times 963m$). The difference between these figures is 76m.
6. **D** – Whether an envelope has pre-paid postage has no impact on whether it can be sorted by machine. All other responses address reasons why an item cannot be machine sorted.
7. **B** – The CEO wonders if the ‘benefits outweigh the risks’ with regards to stopping the process of stamp cancellation. Response B is the only response that articulates both a valid benefit (gain in time) and a valid risk (lost revenue from fraud).
8. **A** – If more staff are employed who do not have any paid hours spent not working, this will reduce the average paid hours spent *not* working for the entire employee base, which is the trend indicated in Table 2. The other responses would, if anything, only serve to *increase* the paid hours not working, contrary to the data in Table 2.

9. **C** – This is the only response that does not explain why staff may be handling a lower rate of items per hour – it merely addresses the number of hours worked. Response A is a potential reason because poor staff planning can affect the number of items handled per hour (e.g., too many staff with less to do can result in a slower working speed). Response B is a potential reason because staff may not be motivated to be productive. Response D is a potential reason as there may be a more relaxed atmosphere for part of the month where staff are working slower due to a much lower volume of items.
10. **D** – First, to calculate the total number of employees, we need to divide the total paid hours by 160. This is $(w + n)/160$. Then, to determine the average items per employee, we need to divide the total number of items by the total number of employees. This is $h/(w + n)/160 = (h \times 160)/(w + n)$.
11. **A** – This option is both true, and addresses why the suggested measure may not reflect true staff productivity. For example, high levels of sickness or training in a given sorting office may make productivity look lower than it actually is. Response B refers to machine costs which are not related to staff productivity. Response C is not true as adding staff will only increase total pay. Response D is not true, as larger amounts of manual mail would result in fewer items handled per hour, which *increases* total pay per item handled.
12. **C** – Observe from Exhibit 2 that total hours worked *decreased* while total items arriving *increased* between Weeks 1 and 2. Response A is incorrect – it can be observed that the dotted line increases at a greater rate than the broken line between Weeks -1 and 0, which implies that the proportion is higher in Week 0. Response B cannot be concluded because no information is available on this. Response D is incorrect, as 35 percentage points of the increase in total hours worked was due to hourly staff, while there was only a 25 percentage point increase in items arriving.

National Garbage Inc

13. **C** – From Table 1, the trash collection revenue per month is $t \times n$. As an average month contains *at least* 4 weeks, we can conclude that trash collection revenue per week is *at most* $(t \times n)/4$. For landfill fees, we know that not all processed waste generates revenue – only the waste that is processed from non-NGI trucks. Therefore total revenue from landfill management is *less than* $l \times w$. Therefore we can conclude that total revenue, $r < (t \times n)/4 + l \times w$
14. **D** – Profit per customer dollar spent is the same as profit margin. Table 1 shows that, in these three cities, landfill management has at least twice the profit margin of trash collection (San Diego) and at most six times (Orlando). Response A is incorrect as trash collection generates vastly greater revenues than landfill management and so generates greater profit in all three cities. Response B is incorrect as San Diego has the *highest* revenue from trash collection. Response C cannot be concluded as we cannot calculate landfill revenue precisely because we do not know how much waste was processed from non-NGI trucks.

- 15. C** – We know that volume of trash is built into pricing, therefore NGI’s pricing (and therefore profit margin) should not be affected by the volume of trash collected. There is no indication that fuel cost variations or route complexity are built into pricing, and hence Responses A and D could impact profit margin. Finally, competition in price paid per ton is out of the control of NGI and so Response B could also impact profit margin.
- 16. C** – Let y be the number of customers. The equation to solve with the information given is $100y > 2 \times 0.1 \times 15 \times y + 10,000$. So $97y > 10,000$. The smallest of the listed values which satisfies this is 104.
- 17. C** – The awareness rate can be obtained by dividing the second row of Table 2 by the first row. This produces 68% for small business and 47% for large business, yielding a difference of 21 percentage points.
- 18. D** – It is natural that waste disposal would represent a lower proportion of spending for large businesses, and this is unlikely in itself to impact their awareness and likelihood to use NGI’s services. Response A is valid as fewer total large businesses can result in fewer large business customers for NGI. Response B would impact whether large businesses even consider waste disposal services in the first place. Response C would impact how aware large businesses are of NGI’s services.
- 19. C** – Note that only the first five data points should be considered in this calculation. By drawing the four responses as averages on the chart, it can reasonably be concluded that Response C is the best approximation. Alternatively, the individual values of the data points can be approximated as 1,800, 700, 850, 1,000 and 2,500. The average of these is 1,375, indicating Response C as the best approximation.
- 20. B** – An environmental specialist must be present at all times on the site, which is 168 hours per week. Since there are four environmental specialists, this means that at least one must work more than 40 hours per week. Responses A and D cannot be concluded because we have no information on the different costs of environmental specialists and other staff. Response C cannot be concluded because we have no information on the hours required from other staff.
- 21. B** – Approximating the data points in Chart A, the total tons of waste processed can be estimated to be $1800+700+850+1,000+2,500 = 6,850$. Therefore the total employee cost per ton of waste is $\$7,000/6,850 = \1.02 . Note that it is not necessary to actually perform this final calculation as it is clear that the result is just above \$1.00, which indicates Response B to be the best approximation.

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- 22. C** – Operations costs currently represent 20% of the \$700m in premium income, which is \$140m. Let y be the new premium income required - the equation to solve is $y = 83\% \times y + \$140m$. So $17\% \times y = \$140m$, giving y to be approximately \$825m. This represents approximately an 18% increase.
- 23. C** – Responses B and D are incorrect as operations and administration costs are a small proportion of the underwriting costs. Response A is incorrect as we are told that claims cost has increased in line with premium income, so only a small proportion of this increase would

be realized in profit (around 0.17% profit improvement). However, a 1% reduction in claims cost would be a 0.83% increase in profit, indicating this as the most positive impact.

- 24. A** – Group A contains about 117,000 policies (= 350,000 x 33%). At an average claims cost of \$200 per policy, total claims cost for Group A is about \$24m. However, premium income for these policies is 2% of the total premium income of \$700m, which is \$14m. This implies an average underwriting loss on these policies. Since we do not have any data on individual policies, we cannot conclude Response B. We cannot conclude Responses C and D as we have no information regarding the potential impact of these actions.
- 25. B** – From Exhibit 3, approximately half of premium income is shared between the 700 Class A and Class C brokers while the other half is shared between 300 Class B brokers. This implies that Class B brokers generate greater average premium income. Similar logic can demonstrate that the other responses are incorrect.
- 26. D** – This is the response that provides the most direct argument for the necessity of discontinuing business with underperforming brokers. The other responses do not directly articulate *why* this business needs to be discontinued, but they are factors that may influence the decision.