

Bonus exercise (hypothesis testing)

This exercise is all about the limits of our ability to test things. When you choose a 5% significance level you have decided, that 5% of the time, you will conclude erroneously that your null-hypothesis can be rejected. This can cause problems when you test multiple things. It is called the ‘multiple testing problem’.

Case: A coffee producer runs a survey every year about the quality of their coffee. The survey consists of a *random* sample of the customers who are asked to answer a long list of questions on a scale from 1 to 50 (where 1 is completely dissatisfied, and 50 is completely satisfied).

For this exercise, you will have the data for 2016 and 2017 (which is not real data but simulated for the purpose of this exercise). You are asked to run a statistical test to reveal where customer opinions have changed.

- a) Please run a z-test for whether the average of customer responses for each question are different in 2018 than in 2017

You will find that 11 of the questions are significantly different. (Or something similar depending on the specifics of the test you run).

- b) Please write an executive summary of the results (which things have changed at a 5% significance level?)

It should look something like this (depending on the exact method you have used):

There is a significant change for Q7, Q17, Q23, Q43, Q44, Q59, Q68, Q72, Q75, Q82, Q94

People are generally more satisfied with the temperature (Q7)

People are generally more satisfied with cleanliness (Q17)

People are generally more satisfied with the seasonal availability of special coffee (Q23)

People are less satisfied with delivery options (Q43)

The speed of the online ordering system has improved (Q44)

The intensity of the coffee is experienced more positively (Q59)

Staff might be worse at personalization of orders (Q68)

There might be a problem with health and safety protocols (Q72)

The smoothness of coffee preparation is experienced as much worse than last year (Q75)

Food and coffee pairing has generally improved (Q82)

People are overall less satisfied with our shops than other places they go, compared to last year (Q94)

c) What would you recommend that the coffee chain changes?

Wrong answer: Following the above significant changes: Try to improve this

Right answer: If we test 100 things, we cannot trust a 5 pct significance level anymore. By random chance this would be different (even if there were no differences in reality) in around 5 of the cases. We have to adjust our test procedure to accommodate for this. Generally we cannot trust the results from the above procedure without correction for multiple testing.

List of questions for reference:

General Experience

1. How satisfied are you with the overall quality of the coffee served?
2. How likely are you to return to our coffee shop in the future?
3. How satisfied are you with the variety of coffee options available?
4. How satisfied are you with the consistency of the coffee taste each time you visit?
5. How satisfied are you with the appearance of your coffee when it arrives?
6. How likely are you to recommend our coffee to a friend or colleague?
7. How satisfied are you with the temperature of your coffee?
8. How satisfied are you with the presentation of your coffee?
9. How satisfied are you with the flavor of the coffee?
10. How satisfied are you with the aroma of the coffee?

Quality of Service

11. How satisfied are you with the speed of service at our coffee shop?
12. How satisfied are you with the friendliness of the staff?
13. How satisfied are you with the accuracy of your order?
14. How satisfied are you with the professionalism of the baristas?
15. How satisfied are you with the helpfulness of the staff when making a selection?
16. How satisfied are you with the staff's ability to handle your special requests?
17. How satisfied are you with the cleanliness of the coffee shop?
18. How satisfied are you with the comfort of seating in our shop?
19. How satisfied are you with the noise level in the shop?
20. How satisfied are you with the waiting time for your order?

Coffee Selection & Variety

21. How satisfied are you with the range of coffee blends available?
22. How satisfied are you with the range of non-coffee beverages available?
23. How satisfied are you with the availability of seasonal or special coffees?
24. How satisfied are you with the availability of milk alternatives (e.g., almond, oat)?
25. How satisfied are you with the choice of flavored syrups and toppings?
26. How satisfied are you with the options for customizations (e.g., strength, temperature)?
27. How satisfied are you with the availability of decaffeinated coffee options?
28. How satisfied are you with the availability of iced coffee options?
29. How satisfied are you with the options for non-dairy milk?
30. How satisfied are you with the quality of the coffee beans used?

Price & Value

31. How satisfied are you with the overall value for money of the coffee?
32. How satisfied are you with the pricing of the coffee compared to similar shops?
33. How satisfied are you with the portion size of your coffee for the price?
34. How satisfied are you with any loyalty or rewards programs offered?

35. How satisfied are you with any discounts or promotions offered?

Accessibility

36. How satisfied are you with the location of the coffee shop?

37. How satisfied are you with the parking situation at our coffee shop?

38. How satisfied are you with the accessibility of the coffee shop for people with disabilities?

39. How satisfied are you with the availability of public transportation options near our shop?

40. How satisfied are you with the store hours?

Digital & Ordering Experience

41. How satisfied are you with the coffee shop's mobile app or website?

42. How satisfied are you with the online ordering process?

43. How satisfied are you with the delivery options available?

44. How satisfied are you with the speed of the online ordering system?

45. How satisfied are you with the accuracy of your online orders?

Packaging & Sustainability

46. How satisfied are you with the packaging of your coffee to go?

47. How satisfied are you with the use of sustainable or eco-friendly materials?

48. How satisfied are you with the availability of reusable cup options?

49. How satisfied are you with the environmental sustainability practices of the coffee shop?

50. How satisfied are you with the availability of recycling or waste disposal options?

Atmosphere

51. How satisfied are you with the interior decor of the coffee shop?

52. How satisfied are you with the ambiance of the coffee shop?

53. How satisfied are you with the lighting in the coffee shop?

54. How satisfied are you with the cleanliness of the restrooms?

55. How satisfied are you with the temperature of the coffee shop?

56. How satisfied are you with the overall atmosphere for working or studying?

Product Consistency & Experience

57. How satisfied are you with the consistency of the coffee's flavor over time?

58. How satisfied are you with the freshness of the coffee beans?

59. How satisfied are you with the coffee's level of strength or intensity?

60. How satisfied are you with the texture of your coffee (e.g., smoothness, creaminess)?

61. How satisfied are you with the balance between bitterness and sweetness in the coffee?

Specialty Options

62. How satisfied are you with the availability of unique or specialty coffee drinks?

63. How satisfied are you with the quality of our signature coffee drinks?

64. How satisfied are you with the seasonal or limited-time offerings?

65. How satisfied are you with the availability of cold brew coffee options?

Customer Service Experience

66. How satisfied are you with how any complaints or issues were handled?

67. How satisfied are you with the speed of resolving any issues you had during your visit?

68. How satisfied are you with the ability of the staff to personalize recommendations?

69. How satisfied are you with how the staff engages with customers in general?

70. How satisfied are you with the level of attentiveness the staff provides?

Health & Safety

71. How satisfied are you with the cleanliness and hygiene practices at the coffee shop?

72. How satisfied are you with the staff's adherence to health and safety protocols?

73. How satisfied are you with the quality of the air quality or ventilation in the shop?

74. How satisfied are you with the availability of hand sanitizers in the shop?

Coffee Preparation

75. How satisfied are you with the smoothness of the coffee preparation process?

- 76. How satisfied are you with the preparation time for your coffee?
- 77. How satisfied are you with the skill and technique of the barista?
- 78. How satisfied are you with the consistency in the preparation of your coffee?

Experience with Other Offerings (Snacks, Pastries, etc.)

- 79. How satisfied are you with the variety of food items available at the coffee shop?
- 80. How satisfied are you with the quality of pastries or snacks offered?
- 81. How satisfied are you with the freshness of the food items served?
- 82. How satisfied are you with the overall pairing of food with your coffee?

Technology & Innovation

- 83. How satisfied are you with the integration of technology into the coffee shop experience?
- 84. How satisfied are you with the availability of self-service options (e.g., self-order kiosks)?
- 85. How satisfied are you with the use of mobile payment options?
- 86. How satisfied are you with the use of digital loyalty programs or rewards?

Special Events & Promotions

- 87. How satisfied are you with the frequency of special events or promotions held at the coffee shop?
- 88. How satisfied are you with the range of events or promotions offered?
- 89. How satisfied are you with the communication of upcoming events or promotions?
- 90. How satisfied are you with the availability of exclusive offers for loyal customers?

Overall Satisfaction

- 91. How satisfied are you with your most recent experience at our coffee shop?
- 92. How satisfied are you with the overall value you get from visiting our coffee shop?
- 93. How satisfied are you with the overall consistency of your experiences at our coffee shop?
- 94. How satisfied are you with the coffee shop compared to other places you've visited?

95. How satisfied are you with your ability to easily find what you're looking for on the menu?

Future Recommendations & Improvement

96. How likely are you to try new products or services that we offer?

97. How satisfied are you with the opportunity to give feedback or suggestions?

98. How satisfied are you with the speed of responding to your feedback or suggestions?

99. How likely are you to visit more often if we introduced new menu items?

100. How likely are you to share your experience with others?