

NTSE STAGE-I (2018) (For Class X Students) (MAT)

Time: 120 Minutes

Max Marks: 100

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you open the Question Booklet.

1. Use blue/black ball point pen only.
2. Write your Roll No. very clearly (only one digit in on block) on this booklet and on the **ANSWER SHEET**.
3. This test consists of 100 questions of one mark each. All the questions are **COMPULSORY**.
4. Answer to each question by darkening the correct alternative among the four choices on the **ANSWER SHEET**.

Example:

	Q.No.	Alternatives
Correct way:	1	<input type="radio"/> 1 <input type="radio"/> 2 <input checked="" type="radio"/> 3 <input type="radio"/> 4
	Q.No.	Alternatives
Wrong way:	1	<input checked="" type="radio"/> 1 <input checked="" type="radio"/> 2 <input checked="" type="radio"/> 3 <input checked="" type="radio"/> 4

5. Separate sheet has been provided for rough work in this test booklet.

1. 4
 By observation
 x should be 5
 $5 + \frac{25}{5} = 10$
 $\therefore 5^2 + \frac{50}{5^2} = 25 + 2 = 27$
2. 1
 $x + y = 3$
 $x^2 + y^2 = 15$
 we know that
 $(x + y)^2 = x^2 + y^2 + 2xy$
 $(3)^2 = 15 + 2xy$
 $9 - 15 = 2xy$
 $-6 = 2xy$
 Now, $(x - y)^2 = (x + y)^2 - 4(xy)$
 $= (3)^2 - 2(-6)$
 $= 9 + 12 = 21$
3. 2
 Let $\frac{a}{3} = \frac{b}{5} = \frac{c}{7} = 105$
 $\therefore a = 315, b = 525, c = 735$
 $= \frac{315 + 525 + 735}{525} = 3$
4. 3
 $(x + y)^2 = x^2 + y^2 + 2xy$
 $(25)^2 = 425 + 2xy$
 $2xy = 625 - 425 = 200$
 $xy = 100$
5. 1
 $\frac{0.64}{a^2} = 64$
 $\frac{0.64}{64} = a^2$
 $\frac{64}{6400} = a^2$
 $\sqrt{\frac{1}{100}} = a$
 $\frac{1}{10} = a = 0.1$
6. 2
 Quotient = 20
 Divisor = $20 \times 30 = 600$
 Remainder = $600 \div 4 = 150$
 Divident = $600 \times 20 \times 20 + 150 = 12150$
-

7. 4

$$3^{a-2b} = 27$$

$$3^{a-2b} = 3^3$$

$$a - 2b = 3 \quad \dots\dots(i) \text{ [If } a^m = a^n \text{ then } m = n]$$

$$9^{a+b} = 3$$

$$3^{2a+2b} = 3$$

$$2a + 2b = 1 \quad \dots\dots(ii)$$

Adding eq. (i) and (ii)

$$a - 2b + 2a + 2b = 4$$

$$3a = 4$$

$$a = \frac{4}{3} \quad \text{[Put the value of a in equation (i)]}$$

$$\frac{4}{3} - 2b = 3$$

$$\frac{4}{3} - \frac{3}{1} = 2b$$

$$\frac{4-9}{3} = 2b = -\frac{5}{6} = b$$

Now, $\frac{a}{b} = \frac{\frac{4}{3}}{-\frac{5}{6}} = \frac{4}{3} \times \frac{6}{5} = \frac{8}{5}$

8. 4

$$\sqrt{17 + x\sqrt{11}} = \sqrt{11} + 6\sqrt{6}$$

S.B.S. (squaring both sides)

$$17 + x\sqrt{11} = 11 + 6 + 2\sqrt{66}$$

$$17 + x\sqrt{11} = 17 + 2\sqrt{66}$$

$$x\sqrt{11} = 2\sqrt{66}$$

$$x = 2\sqrt{\frac{66}{11}} = 2\sqrt{6}$$

$$x^2 = 24$$

9. 1

$$\sqrt{0.02 \times 0.2 \times a} = 0.2 \times 0.2 \sqrt{b}$$

$$\sqrt{\frac{2}{100} \times \frac{2}{10} \times a} = \frac{2}{10} \times \frac{2}{10} \times \sqrt{b}$$

$$\frac{2}{10} \sqrt{\frac{a}{10}} = \frac{2}{10} \times \frac{2}{10} \times \sqrt{b}$$

$$\sqrt{\frac{a}{10}} = \frac{2}{10} \times \sqrt{b}$$

$$\frac{\sqrt{a}}{\sqrt{10}} = \frac{2 \times \sqrt{b}}{10}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \frac{2\sqrt{10}}{10}$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{40}{100}}$$

$$\frac{a}{b} = 0.4$$

10. 1
 Sum of roots = $7 - \sqrt{3} + 7 + \sqrt{3} = 14$
 Product of roots = $(7 - \sqrt{3})(7 + \sqrt{3}) = 49 - 3 = 46$
 Quadratic equation $kx^2 - (\text{sum of roots})x + \text{product of roots} = 0$
 $x^2 - 14x + 46 = 0$

11. 2
 In a triangle PQR
 $\angle Q = 3\angle R = 2(\angle P + \angle R)$
 We know that sum of angles of a triangle is 180°
 $\angle P + \angle Q + \angle R = 180^\circ$
 $(\angle P + \angle R) + \angle Q = 180^\circ$
 $\frac{3}{2}\angle R + 3\angle R = 180^\circ$
 $9\angle R = 180^\circ \times 2$
 $\angle R = \frac{180 \times 2}{9} = 40^\circ$
 Then $\angle Q = 3\angle R$
 $= 3 \times 40 = 120^\circ$

12. 2
 $\frac{p}{q} = \frac{x+3}{x-3}$
 Applying components and Dividends
 $\frac{p+q}{p-q} = \frac{x+3+x-3}{x+3-x+3}$
 $\frac{p+q}{p-q} = \frac{2x}{6}$
 $\frac{p+q}{p-q} = \frac{x}{3}$
 Again applying components and Dividends
 $\frac{p+q+p-q}{p+q-p+q} = \frac{x+3}{x-3}$
 $\frac{2p}{2q} = \frac{x+3}{x-3}$
 Squaring both sides
 $\frac{p^2}{q^2} = \frac{x^2+6x+9}{x^2-6x+9}$
 $\frac{p^2+q^2}{p^2-q^2} = \frac{x^2+6x+9+x^2-6x+9}{x^2+6x+9-x^2+6x-9}$
 Applying components and Dividends
 $\frac{p^2+q^2}{p^2-q^2} = \frac{2x^2+18}{12x} = \frac{2(x^2+9)}{12x}$
 Now, $\frac{p^2-q^2}{p^2+q^2} = \frac{6x}{x^2+9}$

13. 1
Perimeter of a square = $2(24 + 12) = 72$
Side of square = $\frac{72}{4} = 18$
Area of square = $18 \times 18 = 324$
14. 1
 $\frac{\frac{1}{3}\pi(1)^2 \times h}{\frac{1}{3}\pi(2)^2 \times H} = \frac{2}{3}$
 $\frac{h}{H} = \frac{8}{3} = 8 : 3$
15. 3
 $x = 3y - 3$
 $x - 2y - 6$
 $\therefore x = 24$
 $y = 9$
 $x + y = 24 + 9 = 33$
16. 1
Let two numbers are x and y
According to question
 $(x - y) : (x + y) : xy$
 $1 : 7 : 24$
 $(x - y)^2 = (x + y)^2 - 4xy$
 $(1a)^2 = (7a)^2 - 4(24a)$
 $a^2 = 49a^2 - 96a$
 $48a^2 - 96a = 0$
 $48a(a - 2) = 0$
 $a = 2$
So product of the two numbers is $24 \times 2 = 48$.
17. 1
Arrange the given observations in ascending order
6, 7, 7, 7, 9, 9, 14, 15
Mode = 7
Range = $15 - 6 = 9$
 $\left(\frac{8}{2}\right)$ term + $\left(\frac{8}{2} + 1\right)$ term
Median = $\frac{\left(\frac{8}{2}\right) + \left(\frac{8}{2} + 1\right)}{2}$
 $= \frac{7 + 9}{2} = 8$
Now mean = $\frac{\text{median} + \text{mode} + \text{Range}}{3}$
 $= \frac{8 + 7 + 9}{3} = \frac{24}{3} = 8$

18. 4
 Let income 300
 Expenditure = 80% of 300 = 240
 Income = $300 + 16\frac{2}{3}\%$ of 300 = 350
 Expenditure = $240 + 37\frac{1}{2}\%$ of 240 = 330
 Saving = $\frac{20}{350} \times 100 = 5\frac{5}{7}\%$

19. 3
 Let cost of table = x
 Cost of chair = y
 $5x + 5y = 3110$
 $x - y = 210$
 $x = 520$
 $y = 310$
 $2x + 2y = 2(520 + 310) = 1660$

20. 2
 $5 = a + \frac{1}{1 + \frac{1}{6 + \frac{1}{2}}}$
 $5 = a + \frac{1}{1 + \frac{13}{2}}$
 $5 = a + \frac{1}{1 + \frac{13}{2}}$
 $5 = a + \frac{1}{\frac{15}{2}}$
 $5 = a + \frac{2}{15}$
 $a = \frac{62}{15}$

21. 4
 Let the number $8 \times 7 = 56$
 $56 \times \frac{7}{8} - 56 \times \frac{5}{7} = 9$
 If difference is 9, then number = 56
 If difference is 5, then number = $\frac{56 \times 5}{9} = \frac{280}{9}$
 $\therefore 9 \times \frac{280}{9} = 280$

22. 3
 Height of cone (h) = 24 cm
 Base of cone (r) = 6 cm
 Volume of sphere = volume of cone [∵ cone melted and reshape into a sphere]

$$\frac{4}{3} \pi R^3 = \frac{1}{3} \pi r^2 h$$

$$R^3 = \frac{6 \times 6 \times 24}{4}$$

$$R = 6 \text{ cm}$$

$$\frac{1}{3} \pi \times 6^2 \times 24 = \frac{4}{3} \pi r^3$$

$$r = 6$$

$$\therefore 4\pi r^2 = 144\pi \text{ sq. cm}$$

23. 4
 Let total work 60 unit
 (LCM of 10, 12, 15)
 Work done by P + Q = $\frac{60}{10} = 6$ unit/day
 Work done by Q + R = $\frac{60}{15} = 4$ unit/day
 Work done by R + P = $\frac{60}{20} = 3$ unit/day
 Work done by P + Q + R = $\frac{6 + 4 + 3}{2} = \frac{13}{2}$ unit/day
 Work done by R = $\frac{13}{2} - 6 = \frac{1}{2}$ unit/day
 Time taken by R alone = $60 \div \frac{1}{2} = 120$ days

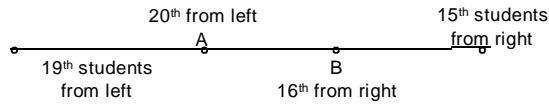
24. 3
 $\sqrt{3}, \sqrt[3]{2}, \sqrt{2}, \sqrt[3]{4}$
 $(\sqrt{3})^6, (\sqrt[3]{2})^6, (\sqrt{2})^6, (\sqrt[3]{4})^6$
 27, 4, 8, 16
 $\therefore \sqrt[3]{2}$ is smallest

25. 4
 By options
 $8R + 8P + 8S + 8Q = 57$
 $8 \times 8 + 8 \div 8 - 8 = 57$

26. 4
 Quantity of milk = $60 \times \left(1 - \frac{12}{60}\right)^2$
 $60 \times \frac{16}{25} = 38.4$

27. 4
 $15 \times 3 + 1 = 46$
 $12 \times 3 + 1 = 37$
 $9 \times 3 + 1 = 28$
 $8 \times 3 + 1 = 25$
 $\therefore 33$ is different

28. 3



By observation

A's final position from left = 30

A's final position from right = 16

Total boys = $30 + 16 - 1 = 45$

29. 1

Number of small cubes on each edges = $\frac{15}{3} = 5$

Small cubes have only one face = $6(5 - 2)^2 = 54$

30. 2

Let present age of son = x yrs

Age of father when his son born = 3x yrs

Now, present age of father = (3x + x) yrs

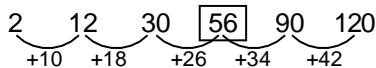
$4x = 48$

$x = 12$

4 yrs ago age of boy is (12 - 4) yrs

i.e., 8 yrs

31. 2



[∵ 120 should be replaced with 132]

Or

$$2^2 - 2 = 2$$

$$4^2 - 4 = 12$$

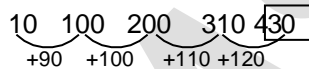
$$6^2 - 6 = 30$$

$$8^2 - 8 = 56$$

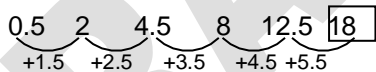
$$10^2 - 10 = 90$$

$$12^2 - 12 = 132$$

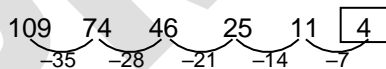
32. 4



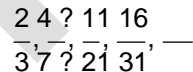
33. 4



34. 4



35. 4



Number are 2, 4, ?, 11, 16

Pattern +2, +3, +4, +5

So answer is 7

Denominator's are 3, 7, ?, 21, 31

Pattern +4, +6, +8, +10

So, answer is 13

36. 3
 Total apples in a basket = $12 \times 12 = 144$ [1 dozen = 12 things]
 Two dozen are added,
 Now, total apples = $144 \times 24 = 168$
 Ten apples spoil and are removed
 Now, remaining apples are $168 - 10 = 158$
 Remaining apples are transferred equally into two baskets
 Then each basket have $\frac{158}{2} = 79$

37. 2
 Time between 8 and 9 will the hands of a clock be together is
 $(8 \times 30) \times \frac{2}{11}$ min past 8 o'clock
 i.e., $\frac{480}{11}$ min past 8 o'clock
 [between h to (h + 1) hours \rightarrow hand of a clock will be together]
 [$\therefore 30h \times \frac{2}{11}$ min past h hour]
 $43\frac{7}{11}$ min past 8 o'clock

38. 4

9	A	12
B	10	7
8	C	11

Sum of each column, each row and diagonal is same
 So, sum of diagonal = $9 + 10 + 11 = 30$
 Hence,
 $9 + 8 + B = 30$
 $B = 13$
 and
 $9 + A + 12 = 30$
 $A = 9$
 $8 + C + 11 = 30$
 $C = 11$

39. 3

$$\frac{7^{n+3} + 14 \times 7^{n+4}}{7^{n+3}}$$

$$= \frac{7^{n+3}(1 + 14 \times 7)}{7^{n+3}}$$

$$= 1 + 98 = 99$$

40. 1
 $\tan x = 5 - \sqrt{3}$
 $\cot x = \frac{1}{\tan x} = \frac{1}{5 - \sqrt{3}} \times \frac{5 + \sqrt{3}}{5 + \sqrt{3}}$
 $= \frac{5 + \sqrt{3}}{(5)^2 - (\sqrt{3})^2} = \frac{5 + \sqrt{3}}{22}$
 Now, $22 \tan (90 - x) = 22 \times \cot x$
 $= 22 \times \frac{5 + \sqrt{3}}{22} = (5 + \sqrt{3})$

41. 4

$$a = \frac{1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{2+3\sqrt{3}}{1}$$

$$\text{Now, } a^2 = (2 + \sqrt{3})^2 = (2)^2 + (\sqrt{3})^2 + 2(2)(\sqrt{3})$$

$$= 4 + 3 + 4\sqrt{3}$$

$$= 7 + 4\sqrt{3}$$

$$b = \frac{1}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}} = \frac{2-3\sqrt{3}}{1}$$

$$\text{and, } b^2 = (2 - \sqrt{3})^2 = (2)^2 + (\sqrt{3})^2 - 2(2)(\sqrt{3})$$

$$= 4 + 3 - 4\sqrt{3}$$

$$= 7 - 4\sqrt{3}$$

$$7a^2 + 11ab = 7b^2$$

$$= 7a^2 - 7b^2 + 11ab$$

$$= 7(a^2 - b^2) + 11ab$$

$$= 7(8\sqrt{3}) + 11(1)$$

$$= 56\sqrt{3} + 11$$

42. 1

Let total capacity of the tank (LCM of 12, 15 and 10) = 60 litres

A can fill a tank in 12 minutes

i.e., In 1 minute A can fill = 5 litre

B can fill a tank in 15 minutes

i.e., In 1 minute B can fill = 4 litre

C can empty a tank in 10 minutes

i.e., in 1 minute C can empty = 6 litre

If all pipes are opened simultaneously then A, B and C fill (in 1 minute) = (5 + 4 - 6) litre

Now If all pipes are opened simultaneously then in

$$\frac{60}{3} = 20 \text{ minutes}$$

they fill the tank.

43. 1

Principle = Rs. P

Rate = 3% p.a

Time = t years

$$\text{Simple interest} = P \times \frac{3t}{100}$$

$$\text{Amount} = P + \frac{P \times 3t}{100}$$

$$P + \frac{3Pt}{100} = 800$$

$$P \left(1 + \frac{3t}{100} \right) = 800 \quad \dots\dots(i)$$

Dividing eq. (ii) by (i)

$$P \left(1 + \frac{5t}{100} \right) = 1000$$

$$\frac{P \left(1 + \frac{5t}{100} \right)}{P \left(1 + \frac{3t}{100} \right)} = \frac{1000}{800}$$

Principle = Rs. P

Rate = 5% p.a.

Time = t year

$$\text{Simple interest} = P \times \frac{5t}{100}$$

$$\text{Amount} = P + \frac{5Pt}{100}$$

$$P + \frac{5Pt}{100} = 1000$$

$$P \left(1 + \frac{5t}{100} \right) = 1000 \quad \dots\dots(ii)$$

$$4 + \frac{20t}{100} = 5 + \frac{15t}{100}$$

$$\frac{20t}{100} - \frac{15t}{100} = \frac{5t}{100} = 1$$

t = 20 years
 Now, $P \left(1 + \frac{3 \times 20}{100} \right) = 800$

$$P \left(\frac{8}{5} \right) = 800$$

$$P = \frac{800 \times 5}{8}$$

$$P = \text{Rs. } 500$$

44.

$$x^2 - 2x - 1 = 0$$

If a and b are roots of $x^2 - 2x - 1 = 0$

In the quadratic equation $ax^2 + bx + c = 0$

Then sum of roots $(a + b) = -(-2) = 2$

$$[\therefore \text{sum of roots} = \frac{\text{coeff. of } x}{\text{coeff. of } x^2}]$$

and product of roots $ab = -1$

$$[\therefore \text{product of roots} = \frac{\text{constant term}}{\text{coeff. of } x^2}]$$

$$\text{Now } a^2b + ab^2 = ab(a + b)$$

$$= (-1)(2) = -2$$

45.

$$k = \frac{20}{100} \times \frac{60}{100} \times 100000$$

$$k = 12,000$$

46.

$$\frac{1}{100} \times \frac{60}{100} \times 100000$$

$$= 3000$$

47.

$$\frac{3}{100} \times \frac{60}{100} \times 100000$$

$$= 9000$$

48.

$$WB = \frac{60}{100} \times \frac{20}{100} \times 100000$$

$$= 12,000$$

$$M = \frac{5}{100} \times \frac{20}{100} \times 100000$$

$$= 10000$$

$$\text{Ratio} = 12000 : 1000$$

$$= 12 : 1$$

49. 3
 $WB = \frac{20}{100} \times \frac{20}{100} \times 100000$
 $= 40000$
 $N = \frac{5}{100} \times \frac{20}{100} \times 100000$
 $= 1000$
 Difference = 4000 – 1000 = 3000

50. 2
 The number of ways in which 6 students can be seated at a round table is $(6 - 1)! = 5!$
 $5 \times 4 \times 3 \times 2 \times 1 = 120$ ways

51.
 ABCDEFG ZYXWUVT BCDEF YXWVU CDE XWV W D
 The above pattern should be followed.
 Therefore incorrect question.

52. 3
 $R > P > S > Q > T$

53. 3
 As 6th to the left of 19th from the left end is W

54. *
 No such consonants are there.
 All option are incorrect.

55. 2
 7 M 4 P J V 1 8 3 E W 2 Q 16 T A 8 Z 15 F U 9 H N

Solutions (Q. 56 to 60):

Days	Name of Person	Perform in Stage shows
Monday	D	Speech
Tuesday	A	Monologue
Wednesday	F	Dance
Thursday	B	Play
Friday	G	Mimicry
Saturday	C	Debate
Sunday	E	Music

56. 2

57. 4

58. 1

59. 4

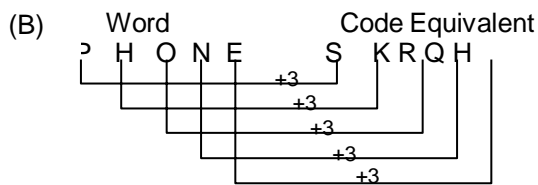
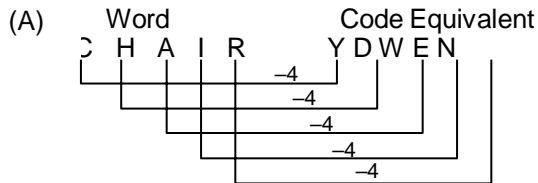
60. 4

Solutions (Q. 61 to 63):

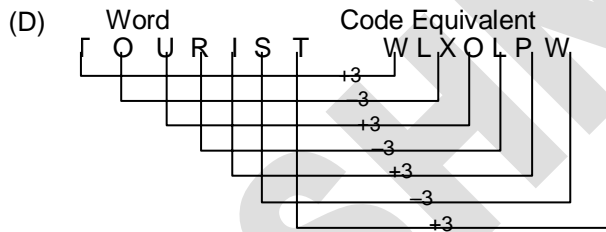
61. 3
 By observation

62. 1
By observation
63. 2
By observation
64. 2
By observation

Solutions (Q. 65 to 67):

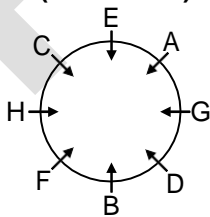


(C) FROUPE → GILFKV
Each letter in the word is replaced by the letter which occupies the same position from the other end of the alphabet to obtain the code.



65. 2
By observation
66. 1
By observation
67. ★
QLFIMZQ → last Q replaced by O.
Question incorrect

Solutions (Q. 68 to 70):



68. 2

69. 1
70. 4
71. *
All option are incorrect
72. 4
BHAGAT, BHAGIRATH, BHAGWAN, BHAGWAT
73. 1
As M is the father of S and P is the daughter of S
So, P is the grand daughter of M.
74. 3
 $Z = 26 \times 2 = 52$
 $ACT = 1 + 3 + 20 = 24 \times 1$
 $\therefore BAT = 2 + 1 + 20 = 23 \times 2 = 46$
75. 3
 $20 \times 3 = 60 \times 3 = 180$
 $4 \times 5 = 20 \times 5 = 100$
 $7 \times 7 = 49 \times 7 = 343$
76. 4
 $1 \leftrightarrow 5$
 $2 \leftrightarrow 6$
 $3 \leftrightarrow 4$
77. *
There are 15 straight lines.
All option are incorrect.
78. 1
By observation
79. 3
By observation
80. 4
KILOMETER after replacement
Word \rightarrow EEILNMOSU
81. 1
By observation
82. 2
By observation
83. *
All option are incorrect.
84. 2
I $\rightarrow 4 \times 2 \times 3 = 24 - 4 = 20$
II $\rightarrow 5 \times 4 \times 2 = 40 - 12 = 28$
III $\rightarrow 3 \times 2 \times 4 = 24 - 4 = 20$
Total = $20 + 28 + 20 = 68$
-

85. 2
We have total number of squares = $8^2 + 7^2 + 6^2 + 5^2 + 4^2 + 3^2 + 2^2 + 1^2$
= $64 + 49 + 36 + 25 + 16 + 9 + 4 + 1$
= 204
86. ★
All option are incorrect.
87. 4
By observation
88. 4
By observation
89. 2
By observation
90. 1
By observation
91. 2
By observation
92. ★
All option are incorrect.
93. 4
By observation
94. ★
All option are incorrect.
95. 3
By observation
96. ★
All option are incorrect.
97. 4
By observation
98. 1
By observation
99. 2
By observation
100. 4
By observation

ANSWER KEY

1.	4	2.	1	3.	2	4.	3
5.	1	6.	2	7.	4	8.	4
9.	1	10.	1	11.	2	12.	2
13.	1	14.	1	15.	3	16.	1
17.	1	18.	4	19.	3	20.	2
21.	4	22.	3	23.	4	24.	3
25.	4	26.	4	27.	4	28.	3
29.	1	30.	2	31.	2	32.	4
33.	4	34.	4	35.	4	36.	3
37.	2	38.	4	39.	3	40.	1
41.	4	42.	1	43.	1	44.	1
45.	3	46.	1	47.	3	48.	2
49.	3	50.	2	51.	*	52.	3
53.	3	54.	*	55.	2	56.	2
57.	4	58.	1	59.	4	60.	4
61.	3	62.	1	63.	2	64.	2
65.	2	66.	1	67.	*	68.	2
69.	1	70.	4	71.	*	72.	4
73.	1	74.	3	75.	3	76.	4
77.	*	78.	1	79.	3	80.	4
81.	1	82.	2	83.	*	84.	2
85.	2	86.	*	87.	4	88.	4
89.	2	90.	1	91.	2	92.	*
93.	4	94.	*	95.	3	96.	*
97.	4	98.	1	99.	2	100.	4
