A.E.E's (ASSISTANT EXECUTIVE ENGINEERS)

CIVIL ENGINEERING – 1987

1. The ratio of maximum shear to the mean shear stress in case of a beam of circular cross section is

1) 4 : 3 2) 3 : 2 3) 5 : 4 4) 2 : 1

2. For punching a hole of 20 mm dia in a plate 20 mm thick, if the shear stress is 30 kgs/ sq. mm. the force required in kg would be

1) 10,000 2) 18,850 3) 28,850 4) 37,699

3. If E & K be the Young's modulus and Bulk modulus of a material the ratio E/K is

1) $1 + \left(\frac{2}{m}\right)$ 2) $1 - \left(\frac{2}{m}\right)$ 3) $1 + \left(\frac{1}{2m}\right)$ 4) $1 - \left(\frac{3}{m}\right)$

4. A short cast iron column carries a load of 80 MT. If the original diameter is 8 cm & $E_s = 1 \times 10^6$ kg/sq.cm and Poisson's ratio = 0.25 then the increase in dia. of column in cm would be

1) 0.00318 2) 0.00216 3) 0.00164 4) 0.00288

5. An element has a tensile stress of 6000 Ksc and compressive stress of 4000 Ksc acting on two mutually perpendicular planes, and two equal shear stresses of 1,000 Ksc on these planes the maximum (tensile) principal stress would be, in Ksc

1) 5,200 2) 4,125 3) 8,600 4) 6,095

6. For a column fixed at one end and free at the other, the Euler's crippling load is

1) $\frac{\pi^2 E I}{L^2}$ 2) $\frac{2 \pi^2 E I}{L^2}$ 3) $\frac{\pi^2 E I}{4 L^2}$ 4) $\frac{\pi^2 E I}{2 L^2}$

7. Column of given length, cross – section area and material have different buckling loads for different end conditions, the strongest column is one for which

1) one end is fixed and the other hinged

2) both ends hinged

3) one end fixed and other free

4) both ends fixed

8. If a member is subject to a tensile force 'P' having its normal cross section 'A', the resulting shear stress in an oblique plane inclined at an angle 'θ' its transverse plane will be

1) $\frac{P \sin^2 \theta}{A}$ 2) $\frac{P \sin 2\theta}{2A}$ 3) $\frac{P \cos \theta}{2A}$ 4) $\frac{P \cos^2 \theta}{A}$

9. Modulus of rigidity is given by

1) $\frac{\text{Lateral strain}}{\text{longitudinal strain}}$ 2) $\frac{\text{Compressive stress}}{\text{strain}}$

3) $\frac{\text{tensile stress}}{\text{tensile strain}}$ 4) $\frac{\text{shear stress}}{\text{shear strain}}$

10. A shaft 10 cm dia and 2 m. long is subjected to torque of 800 kg/m The maximum shear stress, in kg/sq. cm developed is

1) 308.6 2) 407.4 3) 128.6 4) 216.2

11. A shaft transmits 80 H.P. at 60 rpm. If the maximum torque is 30% greater than the mean, the maximum torque is kg.m. is

1) $\frac{1800}{\pi}$ 2) $\frac{3200}{\pi}$ 3) $\frac{1920}{\pi}$ 4) $\frac{3900}{\pi}$

12. The ratio of moments of resistance of a solid circular shaft of dia. 'D' and hallow shaft of external dia. 'D' and internal dia 'd' is

1) $D^4 (D^4 - d^4)$ 2) $\frac{D^3}{(D^3 - d^3)}$ 3) $\frac{(D^4 - d^4)}{D^4}$ 4) $\frac{(D^3 - d^3)}{D^3}$

13. A prismatic beam of length L is simply supported at its ends and subjected to a total U.d.l of W spread over its entire span. It is then propped at its centre to neutralise the deflection. The net B.M/ at its centre will be

1) WL 2) $\frac{WL}{3}$ 3) $\frac{WL}{24}$ 4) $\frac{WL}{32}$

14. A cantilever of flexural rigidity EI and span L is subjected to a moment M at its free end. The slope at its free and would be

1) $\frac{ML}{2EI}$ 2) $\frac{ML^2}{E\,I}$ 3) $\frac{ML}{E\,I}$ 4) $\frac{ML}{4E\,I}$

15. A simply supported beam of width 'b' and depth 'd' subject to a load W at its centre causing deflection 'y' at that point. If the beam be turned such that its width is 'd' and depth is 'b' and be subject to same load at same point, the Central deflection would be

1) $\left(\frac{d}{b}\right) y$ 2) $\left(\frac{dy}{b}\right)^2$ 3) $\left(\frac{d}{b}\right)^2 y$ 4) $\left(\frac{b}{d}\right) y$

16. IN boiler plate the principal stresses across two perpendicular planes are 600 Ksc and 300 Ksc both tensile, Poission's ratio is 0.3 The stress in Ksc, which acting alone would produce the same maximum strain is

1) 510 2) 430 3) 620 4) 300

17. The equivalent length of a column fixed at one end and free at the other is

1) 0.5 L 2) 0.7 L 3) L 4) 2 L

18. A steel plate is subject to tensile stresses of 800 and 500 Ksc at right angles to each other. The normalstress is Ksc on a plane inclined at 60 degrees to the 800 Ksc stress would be

1) 600 2) 360 3) 840 4) 725

19. Materials which exhibit same elastic properties in all directions are called

1) Homogeneous 2) Isentropic 3) Allotropic 4) Isotropic

20. A steel shaft 5 cm. dia and 50 cm long is subject to a twisting couple of 11,000 kg. cm. If the angle of twist be 0.6 degree modulus of rigidity of material of shaft in Kg/sq.cm

1) 0.762×10^6 2) 0.936×10^6 3) 0.856×10^6 4) 0.892×10^6

21. For a given stress, the moment of resistance of a beam of square section placed with two sides horizontal, is K times the moment of resistance of the same beam section placed with a diagonal horizontal, where K is

1) $\sqrt{3}$ 2) $\sqrt{2}$ 3) 1.5 4) 1.8

22. Two beams carrying identical loads, simply supported have same width, but beam A has double the depth of beam B. The elastic strength of beam A is K times that of beam B, where K is

1) 2 2) 4 3) 8 4) 6

23. A horizontal beam is simply supported at its ends and carries a, u.d.I. of 3 T/m between supports places 10 m. apart, counter clockwise moments of 14 and 10 T.m. are applied at the left and right supports respectively. The shear force in tons at support A is

1) 14 2) 17.4 3) 13.6 4) 15

24. A beam A B D is 8 m long and is simply supported at A and at a point B such than AB = 6 m. A point load of 1.5 T acts at D, and a total u.d.I of 8 T acts over half of AB. The shear force at A in Tons would be

1) 6 2) 8 3) 5.5 4) 7.5

25. A fixed beam of span L carries a concentrated load W at mid point. The beam has flexural rigidity EI the deflection at the mid-point of beam is

1) $\frac{WL^3}{128}$ EI 2) $\frac{WL^3}{192}$ EI 3) $\frac{WL^2}{64}$ EI 4) $\frac{WL^3}{384}$ EI

26. A cantilever beam of rectangular cross-section carries a point load W at its free end. If the depth of beam is doubled, and the load halved, the deflection of the free end, as compared to its original value, will be

1) $\frac{1}{2}$ 2) $\frac{1}{4}$ 3) $\frac{1}{8}$ 4) $\frac{1}{16}$

27. Two beams of corss-section circular and square have the same length, same allowable bending stress, and the same moment of resistance. The 'wl' of the beam with circular section is K times that of the square section, where 'K' is

1) 0.852 2) 1.118 3) 1.856 4) 2.00

28. Two shafts are made of same material and same outer dia. with one having a circular section, and the other a hallow circular section with inner dia. half that of outer dia. the torqe than can be transmitted by the solid section is N time that of the hollow section, where N is

1) $\frac{8}{7}$ 2) $\frac{17}{16}$ 3) 1.5 4) $\frac{15}{16}$

29. A shaft is simultaneously subject to a torque T and a bending moment M. The ratio of maximum bending stress and maximum shearing stress is

1) $\frac{M}{T}$ 2) $\frac{T}{M}$ 3) $\frac{2M}{T}$ 4) $\frac{2T}{M}$

30. A bar of rectangular section is tension under an axial stress of 200 kg/ sq.cm If poission's ratio is $\frac{1}{3}$ for the material, the stress to be applied to the side faces, to prevent any change in cross sectional dimensions, in kg/sq.cm is

1) 80 2) 100 3) 120 4) 96

31. A column hined at both ends in 4m long and has cross-sectional area 145.3 sq.cm. and radius of gyration 6.25 cm. Assuming fc = 5500 kg/sq.cm. and $\alpha = \frac{1}{1600}$. The rankine's cripling load in tons would be

1) 224.6 2) 248.4 3) 316.8 4) 296.6

32. The ratio of effective length of column to its minimum radius of gyration is known as

1) Bukling factor
2) Slenderness ratio
3) Crippling factor
4) Section modular

33. The relation between the three elastic constants is

1) $E = \frac{3KC}{(K + C)}$
2) $E = \frac{6KC}{(3K + C)}$
3) $E = \frac{9KC}{(3K + C)}$
4) $e = \frac{3KC}{(3K + C)}$

34. A steel rod of sectional area 3 sq.cm. connects two parellel walls 6m apart and when the rodis heated to 100 degrees c, the nuts at the ends are tightened up. The pull exerted by the bar on cooling to 20 degrees C with ends not yielding and assuming.

$\alpha = 0.000012/\ ^\circ C$ $E = 2.1 \times 10^6$ ksc would be in kg.

1) 4056
2) 3482
3) 6057
4) 7218

35. A cast Iron column 5m long is of hollow circular section with internal dia 25 cm and external dia 30 cm. The axiall load in Tonnes which develops a compressive stress of 800 kg/sq.cm. in the column is

1) 96.4
2) 172.8
3) 148
4) 120.6

36. When a shaft is subject to pure twisting, the type of stress developed in the shaft is

1) Bending stress
2) Axial stress
3) Shear stress
4) Normal stress

37. Young's moduls of material is K times its rigidity modulus, when K is

1) $2\left(\frac{1-1}{m}\right)$
2) $3\left(1+\left(\frac{1}{m}\right)\right)$
3) $2\left(1+\left(\frac{1}{m}\right)\right)$
4) $3\left(1-\left(\frac{1}{m}\right)\right)$

38. Poisson's Ratio is the ratio of

1) $\frac{\text{Lateral stress}}{\text{Lateral strain}}$
2) $\frac{\text{Lateral stress}}{\text{Linear strain}}$
3) $\frac{\text{Lateral strain}}{\text{Linear strain}}$
4) $\frac{\text{Linear stress}}{\text{Lateral strain}}$

39. A shaft running at 150 rpm is subject to torque of 150 kg.m. The H.P. transmitted by the shaft is

1) π
2) 10π
3) π^2
4) $\frac{1}{\pi}$

40. In a shaft subject to pure twist, the shear stress at a section is maximum at

1) Centre of section
2) Mid−radius
3) Surface
4) $\frac{3}{8}$ radius from centre

41. A cantilever has length of 2.5 cm. It is of T section with $I_x = 2127\ cm^4$ and fibre distance (tensile) from neutral axis is 7 cm. If the maximum allowable tensile stress is 300 kgs/sq.cm then the maximum u.d.1. that can be applied in kg/m is

1) 368
2) 2409
3) 485
4) 292

42. The width of the strongest beam of rectangular section than can be cut out of a cylinderical log of wood whose dia. is 30 cm. would be (in cm)

1) 10.4
2) 15.6
3) 20.2
4) 17.3

43. A cantilever carries a total u.d.l. of 'W' over its entire length, and a force W acts as its free end upwards. The max. deflection at the free end is

1) Zero
2) $\frac{5\,Wl}{24}$ EI upward
3) $\frac{5Wl}{24}$ EI downward
4) None of these

44. The property of material by which it can be beaten or rolled in to plates is called.

1) Malleability 2) Ductility 3) Plasticity 4) Elasticity

45. A prematic beam ABC is simply supported at points A and spaced 6 m apart and has an overhand BC of 2m. A u.d.1. of 2T/m acts over entire length AC and a point load of 5T acts at C. The hogging moment in T−m at B would be

1) 15 2) 18 3) 24 4) 12

46. A bar of certain material of section 4 Cm^2 is subjected to a pull of 16 T. Thereby the extention is 0.01 cm in length of 20cm. If poisson's ratio is $\frac{1}{4}$, the rigidity Modulus of the material in Kg/Sq.cm. is

1) 2×10^6 2) 1.6×10^6 3) 1.3×10^6 4) 8×10^6

47. Along the principal plane subject to the maximum principal stress there would be

1) Maximum shear stress
2) Minimum shear stress
3) No shear stress
4) None of the above

48. A hollow cylindrical column of Cross-Sectional area 1.7Sq.Cm and I = 1766 Cm^4, is 6m long. If E = 0.8×10^6 kg/sq.cm. the Euler's Crushing load in Kg. is

1) 30,500 2) 28,600 3) 42,000 4) 38,700

49. In a fixed beam of flexural rigidity E I and span L, if one of the Supports Sinks by 'd', the moment consequent of this is

1) $\frac{6\,E\,I\,d^2}{L^2}$ 2) $\frac{6E\,I\,^2d}{L}$ 3) $\frac{6E\,I\,d}{L^2}$ 4) $\frac{6\,E\,I\,^2d^2}{L^2}$

50. A short column of external dia D and internal dia 'd' carries an ecentric load W. The greatest eccentricity which the load can have with out producing tension in the column, is

1) $\frac{(D + d)}{8}$ 2) $\frac{(D^2 + d^2)}{8}$ 3) $\frac{(D + d)^2}{8d^2}$ 4) $\frac{(D^2 + d^2)}{8D}$

51. When a liquid rotates at constant angular velocity about a vertical axis, the pressure

1) Increases linearly as its radial distance
2) Varies inversely as the altitude along any vertical time
3) Varies as Square of the radial distance
4) Decrease as square of the radial distance

52. A triangular channel section will be most economical when each of the sloping sides make with vertical an angle of

1) 30° 2) 60° 3) 40° 4) 45°

53. A Francis turbine is an

1) Inward flow reaction turbine
2) Inward flow impulse turbine
3) Outward flow reaction turbine
4) Outward flow impulse turbine

54. A right circular cylinder open at top, is filled with liquid and rotated about its vertical axis at such speed that half the liquid spills out. The pressure at the centre of bottom is

1) Zero

2) $\frac{1}{8}$ of that when cylinder was full

3) $\frac{1}{4}$ of that when cylinder was full

4) $\frac{1}{2}$ of that when cylinder was full

55. Water hammer in pipes occurs when

1) Excessive leakage occurs

2) pipe is hit with hammer

3) flow of liquid through pipe is suddenly stopped by closing the value

4) pipe bursts under excessive fluid presure

56. The value of friction factor for laminar flow of liquid in terms of Eynolds number R, is given by

1) $\frac{64}{R}$ 2) $\frac{32}{R}$ 3) $\frac{24}{R}$ 4) $\frac{48}{R}$

57. In a free Cylindrical vortrex of water, the tangential velocity at a riadius of 12 cm. from axis of rotation is 7.2 m/ sec and intensity of pressure is 2.5kg/sq.cm. The velocity at a radius of 24 cm. from the axis (in m/sec.) is

1) 2.4 2) 3.2 3) 3.6 4) 4.8

58. The depth of the Centre of pressure of a vertical Semi Circular Plane Submerged in a liquid with dia 'd' at the free Surface is

1) $\frac{\pi d}{16}$ 2) $\frac{\pi d}{32}$ 3) $\frac{\pi d}{12}$ 4) $\frac{3\pi d}{32}$

59. A Cubical Tank of side 2m is filled with glycerine of Sp.gr, 1.6 to a depth of 1.5 m. If the tank is accelerated Vertically upward at 5m/Sec., the force acting on the side of the tank would be in (Kg.)

1) 2448.6 2) 4800 3) 6425.2 4) 5434.5

60. A wooden block of rectangular section 4m long 1.25 wide and 2m deep floats horizontally in Sea water of Sp. wt. 1025kg/cu.m. If the sp.gr. of wood is 0.64, the depth of block under water would be (in m.)

1) 2.4 2) 1.8 3) 0.8 4) 1.25

61. For flow through pipes the head loss by Darcey-Weisbach equation is equal to

1) $\frac{f L V}{2g D}$ 2) $\frac{fI V^2}{g D}$ 3) $\frac{f L V^2}{2g D}$ 4) $\frac{f L^2 V}{2g D}$

62. A certain liquid has a volume of 1 litre when compressed at 1 MN/Sq.m. and a volume of 995 C.C. when compressed to 2MN/Sq.m. The Bulk Modulus of Elasticity would be (in MPa)

1) 10 2) 1000 3) 200 4) 150

63. On an inclined plane, the centre of pressure is located

1) above its centroid 2) below centroid

3) at centroid 4) anywhere

64. Thrust on a plane area is equal to area multiplied by intensity of pressure at centroid if

1) Area is horizontal
2) Area is inclined
3) Area is vertical
4) All the above

65. A pitot tube is used to measure

1) Discharge in a flowing stream
2) Pressure in a static fluid
3) Velocity ini a flowing stream
4) Dynamic pressure

66. If the specific speed of a turbine is 6, then the turbane should be

1) Kaplan 2) Francis 3) Pelton wheel 4) Thompson

67. Mannings formula is used to determine friction head loss in

1) pipes running full
2) pipes running partially
3) open channels
4) irregular sections

68. The discharge through a triangular notch under a constant head of 2.5 cm, if angle of the notch is 120 degrees, assuming Cd = 0.62, is (in Cum/ Sec)

1) 0.180 2) 0.079 3) 0.098 4) 0.667

69. Water is to be pumped out of a deep well under a total head of 95 m. A number of indentical pumps of design speed 1000 rpm and specific speed 900 rpm with a rated capacity of 150 litres/ sec are available. The number of pumps needed would be

1) 2 2) 4 3) 6 4) 3

70. A rectangular weir 6 m long is divided into 3 bays, by 2 vertical post, each 30 cm wide. If the head is 45 cm., the discharge in Cu m/ Sec over the weir, using Franci's formula (considering and contraction) is

1) 2.25 2) 2.85 3) 2.58 4) 2.96

71. A tank 6m long, 2.5 m wide, 2m deep, is fully filled with oil. If it is accelerate in the direction of its length at 1.5m/ sec, the volume of oil spilled in litres, would be

1) 6880 2) 460 3) 5640 4) 6400

72. A ship weighs 13,000 T, when the ship's boats at a mean distance of 10m from the centre, are filled with water, weighing 60 T, the angle of displacement of plumb line is 2° 16'. Given tangent of this angle as 0.0396, the metacentric heights is (in metres)

1) 1.16 2) 1.36 3) 0.96 4) 1.6

73. A vertical gate closes horizontal tunnel 5m high and 3m wide running full with water. The pressure at the bottom of the gate is 2×10^4 Kg/Sq.m. The total pressure on the gate would be, in Kg.

1) 192,000 2) 250,000 3) 262,500 4) 225,000

74. The discharge through a venturimeter, with inlet and throat sectional areas A and B is given by the formula

1) $KAB \frac{\sqrt{2gh}}{(A^2 - B^2)}$ 2) $KAB \frac{\sqrt{gh}}{(A^2 - B^2)}$ 3) $KAB \frac{\sqrt{gh}}{(A - B)^2}$ 4) $KAB \frac{\sqrt{2gh}}{\sqrt{A^2 - B^2}}$

75. If the shaft HP of the motor of a centrifugal pump be P, the overal efficiency of the pump is

1) $\frac{WQH^2}{P}$ 2) $\frac{WQ^2H}{75\ P}$ 3) $\frac{WQH}{75\ P}$ 4) $\frac{WQH}{125\ P}$

76. Hydraulic jump occurs when

1) Flow is Sub–Critical

2) Flow is Super–Critical

3) Flow is Sub–Critical and adequate downstream depth is available

4) Flow is Super–Critical and adequate down stream depth is available

77. Reynold's Number for pipe flow is given by

1) $\frac{VD}{v}$ 2) $\frac{VD\mu}{g}$ 3) $\frac{VDP}{\mu}$ 4) $\frac{VD}{\mu}$

78. When a venturimeter is used in an inclined position it will show

1) Less reading 2) More reading 3) Same reading 4) None

79. A kalpan turbine is suitable for

1) High head, low discharge 2) Low head, high discharge

3) High head, high discharge 4) Low head, low discharge

80. Uniform flow is said to occur in a fluid when

1) Rate of change of velocity is Zero

2) At every point, the velocity vector is identical in magnitude and direction, at any given instant

3) Conditions do not change with time at any point

4) Changes in transverse directions are zero

81. If total head at the nozle of a pipe is 37.5m and discharge is 1 cumec, the HP generated is

1) 550 2) 500 3) 400 4) 450

82. Specific speed of a centrifugal pump is

1) $\frac{\left(N\sqrt{Q}\right)}{H}$ 2) $\frac{\left(N\sqrt{Q}\right)}{H^2}$ 3) $\frac{\left(N\sqrt{H}\right)}{Q}$ 4) None of the above

83. The power transmitted through a pipe is maximum when the loss of head due to friction is K times the head supplied where K is

1) $\frac{1}{4}$ 2) $\frac{1}{2}$ 3) $\frac{1}{3}$ 4) $\frac{2}{3}$

84. The maximum continuous power available from a hydel plant uder the most adverse hydraulic conditions, is know as

1) Base power 2) Firm power 3) Primary power 4) Installed capacity

85. The purpose of a Surge tank in a pipe line is to

1) Minimise friction loss is pipe

2) Smooth flow of water

3) Prevent occurrence of hydraulic jump

4) Relieve pressure due to water-hammer

86. Reynold's number is the ratio of

1) Viscous to inertia forces 2) Elastic to pressure force

3) Gravity to inertia force 4) None of the above

87. A metallic piece of sp.gr. 3.4 floats in mercury of sp.gr. 13.6 The fraction of its volume under mercury is

1) 0.50 2) 0.90 3) 0.25 4) 0.75

88. Bernoulli's equation assumes that

1) Fluid is non−viscous

2) Fluid is homogeneous

3) Flow is steady and along streamline

4) All of the above

89. The water level in a tank is 50m above the centre of circular hole of dia 2.5 cm. The velocity of water coming out through the hole in m/sec, is

1) 31.4 2) 31.2 3) 31.1 4) 31.3

90. The Divergent cone in a venturimeter is kept

1) Equal in length to the Convergent cone

2) Longer than convergent cone

3) Shorter than Convergent cone

4) None of the above

91. Centre of buoyancy is

1) The point of intersection of buoyant force and centre line of body

2) Centre of gravity of the body

3) Centroid of displaced volume of fluid

4) Mid-point between centre of gravity and metacentre

92. Full load is supplied by a turbine shaft when dia. of jet issuing form nozzle is 15 cm. If the load suddenly drops to 36% of full load, the dia. of the jet to be regulated is

1) 7 cm 2) 10 cm 3) 6 cm 4) 9 cm

93. In case of rectangular notch, the ratio of % error in discharge to the % error in the measurement of head is

1) $\frac{1}{2}$ 2) $\frac{3}{2}$ 3) $\frac{3}{4}$ 4) $\frac{2}{3}$

94. A floating body attains stable equilibrium if its metacentre is

1) Above the Centroid 2) Below the Centroid

3) At Centroid 4) Anywhere

95. A rectangular channel section will be most economical when depth of flow is equal to

1) Bottom width 2) Three−fourth bottom width

3) Half bottom width 4) Two−third bottom width

96. For a vertical rectangular gate 4m wide and 3m high, with water surface at top of the gate, the depth of centre of pressure in metres, is

1) 1.0 2) 2.0 3) 1.5 4) 2.5

97. Gauge pressure is equal to

1) Absolute pressure – atmospheric pressure

2) Absolute pressure + atmospheric pressure

3) Atmospheric pressure – Absolute pressure

4) None of the above

98. If a water tank partially filled with water is being carried on a truck moving with constant horizontal acceleration, the level of the liquid will

1) Rise on the front side of tank

2) Remains same

3) Reises on backside and fall in front side

4) Fall on backside of tank

99. Euler's equation of motion of liquids assumes that

1) Fluid is viscous

2) Fluid is homogeneous and in compressible

3) Flow of liquid is unsteady

4) Velocity of flow is non-uniform

100. A turbine develops 10140 HP under a head of 24.7 m at 180 rpm is specific speed in rpm is

1) 247 2) 336 3) 294 4) 304

ANSWERS

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