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Question Booklet No.

**QUESTION BOOKLET**  
**CIVIL ENGINEERING**

Booklet Series

**A**

Roll No.

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(Enter your Roll number in the above space)

**Time Allowed : 2 Hours**

**Maximum Marks : 100**

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3. This Question Booklet contains **100** questions. Each question is printed in **English** only. Each question comprises four responses (answers). You will select the response which you want to mark on the OMR Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each question.
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  - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **0.25 mark** assigned to that question will be deducted as penalty.
  - (ii) If a candidate gives more than one answer, it will be treated as a wrong answer even if one of the given answers happens to be correct and there will be same penalty as above to that question.
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- A cantilever beam of span 2 m is subjected to a downward load of 60 kN distributed uniformly over the entire span and an upward point load  $P$  at its free end. The value of  $P$  for the net deflection at the end to be zero shall be

[A] 45 kN  
[B] 30 kN  
[C] 22.5 kN  
[D] 60 kN
- A trapezium has sides of 20 cm and 10 cm and height of 18 cm. The centre of gravity of the trapezium from 20 cm side shall be

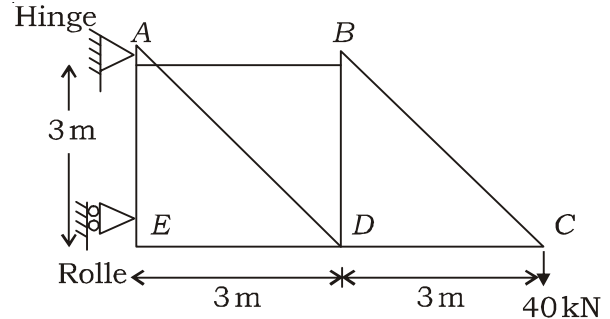
[A] 12 cm  
[B] 10 cm  
[C] 8 cm  
[D] 4.5 cm
- A seconds pendulum executes

[A] 0.5 beat per second  
[B] 1.0 beat per second  
[C] 2.0 beat per second  
[D] 2.5 beat per second
- The Poisson's ratio of a material which has Young's modulus of 100 GPa and shear modulus of 40 GPa is

[A] 0.25  
[B] 0.1  
[C] 0.3  
[D] 0.2
- The slenderness ratio of a column is zero, when

[A] its length is exactly equal to radius of gyration  
[B] its length is half of the radius of gyration  
[C] its length is supported on all sides throughout its length  
[D] total load carried is less than half of the dead weight

- The pin-jointed cantilever truss is loaded as shown below. The force in member  $E$  is



- [A] 40 kN (Compressive)  
[B] 80 kN (Tensile)  
[C] 80 kN (Compressive)  
[D] 120 kN (Tensile)
- In a prestressed member, it is advisable to use

[A] low strength concrete only  
[B] high strength concrete only  
[C] high strength concrete and high tensile steel  
[D] low strength concrete but high tensile steel
  - The maximum shear stress ( $\rho$ ) in a reinforced cement concrete beam subjected to a shear force of 70 kN and having width of 250 mm and a lever arm of 350 mm is

[A]  $0.8 \text{ N/mm}^2$   
[B]  $1.25 \text{ N/mm}^2$   
[C]  $0.00002 \text{ N/mm}^2$   
[D]  $0.0008 \text{ N/mm}^2$

9. An RCC beam, not provided with shear reinforcement, may develop cracks in its bottom inclined roughly to the horizontal at
- [A] 25°
  - [B] 35°
  - [C] 45°
  - [D] 60°
10. The effective span of a simply supported slab is
- [A] distance between the centers of the bearings
  - [B] clear distance between the inner faces of the walls plus twice the thickness of the wall
  - [C] clear span plus effective depth of the slab
  - [D] None of the above
11. A steel plate is 300 mm wide and 10 mm thick. If the diameter of the bolt hole is 20 mm, the net section area of the plate shall be
- [A] 2800 mm<sup>2</sup>
  - [B] 2780 mm<sup>2</sup>
  - [C] 1800 mm<sup>2</sup>
  - [D] 2600 mm<sup>2</sup>
12. A steel column carries an axial load of 800 kN. The lacing system shall be designed for a transverse shear of
- [A] 60 kN
  - [B] 40 kN
  - [C] 80 kN
  - [D] 20 kN
13. Bulking of sand is maximum if moisture content is
- [A] 2%
  - [B] 4%
  - [C] 6%
  - [D] 10%
14. Modulus of rupture of concrete determines
- [A] tensile strength
  - [B] compressive strength
  - [C] modulus of elasticity
  - [D] flexural tensile strength
15. The load carrying capacity of a column reinforced with main steel and ties is 200 kN. If, keeping the main steel same, the ties are replaced by same amount of helical reinforcement satisfying all requirements as per IS : 456, the load carrying capacity shall become
- [A] 190 kN
  - [B] 210 kN
  - [C] 220 kN
  - [D] 180 kN
16. Creep strain of a structural element is
- [A] independent of load
  - [B] caused by live load only
  - [C] caused by dead load only
  - [D] caused by dead load + live load

17. The maximum shear stress developed inside a concrete cube, submerged deep in still water in such a way that pressure exerted on all the faces is  $p$ , shall be
- [A] zero  
 [B]  $2p$   
 [C]  $p/2$   
 [D]  $p$
18. Two soil samples  $A$  and  $B$  have porosities  $n_A = 40\%$  and  $n_B = 60\%$  respectively. What is the void ratio,  $e_A : e_B$ ?
- [A] 2 : 3  
 [B] 3 : 2  
 [C] 4 : 9  
 [D] 9 : 4
19. The ultimate bearing capacity of a shallow foundation on sand is reduced to about \_\_\_\_, when the water table rises to the ground surface.
- [A] 75%  
 [B] 50%  
 [C] 25%  
 [D] 40%
20. In a plate load test conducted on cohesionless soil, a 600 mm square test plate settles by 15 mm under a load intensity of  $0.2 \text{ N/mm}^2$ . All conditions remaining the same, settlement of a 1m square footing will be
- [A] 20-50 mm  
 [B] less than 15 mm  
 [C] 15-60 mm  
 [D] greater than 25 mm
21. The liquid limit and plastic limit of a sample are 65% and 29% respectively. The percentage of the soil fraction with grain size finer than  $0.002 \text{ mm}$  is 24. The activity ratio of the soil sample is
- [A] 0.50  
 [B] 1.00  
 [C] 1.50  
 [D] 2.00
22. In a compaction test, each layer is to be compacted by
- [A] 45 blows  
 [B] 50 blows  
 [C] 30 blows  
 [D] 25 blows
23. The degree of saturation for a natural state in a soil having water content 24%,  $G = 2.5$  and void ratio 1, shall be
- [A] 76%  
 [B] 24%  
 [C] 100%  
 [D] 60%
24. At the intersection of any equipotential line and phreatic line, the pressure head shall be
- [A] one  
 [B] zero  
 [C] less than zero  
 [D] between zero and one
25. The maximum permissible limit of nitrates for public water supply is
- [A] 0 ppm  
 [B] 100 ppm  
 [C] 150 ppm  
 [D] 200 ppm

26. The average daily water consumption of a city is 20000 cum. The peak hourly demand will be
- [A] 24000 cum/hr
  - [B] 22500 cum/hr
  - [C] 27000 cum/hr
  - [D] 18000 cum/hr
27. The most hazardous metal to human beings is
- [A] barium
  - [B] iron
  - [C] silver
  - [D] arsenic
28. Which of the following compounds is used for algae control?
- [A] Copper sulphate
  - [B] Calcium chloride
  - [C] Ferric chloride
  - [D] Ferric sulphate
29. Two primary air pollutants are
- [A] sulphur oxide and ozone
  - [B] nitrogen oxide and peroxyacetyl nitrate
  - [C] sulphur oxide and hydrocarbon
  - [D] ozone oxide and peroxyacetyl nitrate
30. Two biodegradable components of municipal solid waste are
- [A] plastics and wood
  - [B] cardboard and glass
  - [C] leather and tin cans
  - [D] food waste and garden trimmings
31. The ruling minimum radius of horizontal curve on a national highway having a design speed of 90 kmph with a super-elevation of 0.10 and coefficient of lateral friction of 0.15 would be
- [A] 255 m
  - [B] 315 m
  - [C] 375 m
  - [D] 425 m
32. The minimum radius of curve, beyond which no super-elevation is required for a highway having a design speed of 80 kmph and camber of 3%, would be
- [A] 940 m
  - [B] 1680 m
  - [C] 400 m
  - [D] 280 m
33. A transport company operates a scheduled daily truck service between two cities, one-way journey takes 85 hours. A minimum layover of 5 hours is to be provided in each city. How many trucks are required to provide this service?
- [A] 4
  - [B] 8
  - [C] 7
  - [D] 6
34. Rainfall during three successive 2-hour periods are 5 mm, 28 mm and 16 mm. The surface runoff resulting from this storm is 32 mm. The  $\phi$  index value for this storm would be
- [A] 3 mm/hr
  - [B] 6 mm/hr
  - [C] 12 mm/hr
  - [D] 20 mm/hr



- 35.** The hydraulic jump height in a stilling pool of 1:20 scale was observed to be 90 mm. The corresponding prototype height of the jump would be
- [A] 4.5 mm  
[B] 3600 mm  
[C] 1.800 mm  
[D] 180 mm
- 36.** An inert tracer is interjected continuously from a point in an unsteady flow field. The locus of locations of all tracer particles at an instance of time represents
- [A] pathline  
[B] stream tube  
[C] streamline  
[D] strikeline
- 37.** Wheat crop requires 55 cm of water during 120 days of base period. The total rainfall during this period is 100 mm. Assuming irrigation efficiency to be 60%, the land area in hectares which can be irrigated with a canal flow of  $0.01 \text{ m}^3/\text{s}$ , is
- [A] 18.85  
[B] 23.04  
[C] 230.40  
[D] 13.82
- 38.** The thickness of laminar boundary layer on a flat plate at a point *A* is 2 cm and at a point *B*, which is 1 m downstream of *A*, is 3 cm. The distance of leading edge of the plate from *A* is
- [A] 1.25 m  
[B] 1.80 m  
[C] 0.90 m  
[D] 0.80 m
- 39.** The observed magnetic bearing of line *OE* was measured as  $185^\circ$ . It was later observed that station *O* had a local attraction of  $+1.5^\circ$ . The true bearing of the line *OE* considering a magnetic declination of  $3.5^\circ E$  shall be
- [A]  $180^\circ$   
[B]  $190^\circ$   
[C]  $187^\circ$   
[D]  $193^\circ$
- 40.** During a levelling work along a falling gradient using a dumpy level and a staff, following successive readings were taken — 1.785 m, 2.935 m, 0.360 m and 1.320 m. What will be the correct order of booking these four readings in a level book?
- [A] BS, FS, BS, FS  
[B] BS, IS, FS, FS  
[C] BS, IS, IS, FS  
[D] BS, IS, BS, FS
- 41.** If a  $+0.8\%$  grade meets a  $-0.7\%$  grade and rate of change of grade for 30 m distance is 0.05, the length of the vertical curve will be
- [A] 600 m  
[B] 1200 m  
[C] 900 m  
[D] 1000 m
- 42.** The plan of a map was copied to a reduced size such that a line originally 100 mm, measured 90 mm. If the original scale of the plan was 1 : 900, the revised scale would be
- [A] 1 : 1221  
[B] 1 : 1111  
[C] 1 : 1000  
[D] 1 : 900

- 43.** A rod of length  $L$  has a diameter  $d$  till  $L/2$  distance from the left end, and a diameter  $2d$  for the remaining length. If the rod is subjected to a pull of magnitude  $P$ , the maximum stress in the rod will be
- [A]  $4P/\pi d^2$   
 [B]  $8P/\pi d^2$   
 [C]  $16P/\pi d^2$   
 [D]  $P/\pi d^2$
- 44.** In the simple theory of bending, the stress in any fibre of a prismatic beam subjected to a pure bending moment is directly proportional to its distance from the neutral plane, because
- [A] the modulus of elasticity is a constant  
 [B] the strain diagram is linear  
 [C] stress at the neutral plane is zero  
 [D] the neutral plane contains the centroid of the cross-section of the beam
- 45.** The shear force should be applied at the shear center of a beam having a channel cross-section in order to avoid
- [A] bending of the cross-section  
 [B] shear of the cross-section  
 [C] compression of the cross-section  
 [D] twisting of the cross-section
- 46.** If a prismatic fixed beam undergoes settlement ( $\Delta H$ ) at the right support, what type of internal forces will be induced in the beam?
- [A] Shear force only  
 [B] Axial force only  
 [C] Bending moment only  
 [D] Bending moment and shear force
- 47.** Triple constraints in Construction Management are
- [A] time, cost and scope  
 [B] cost, quantity and supply  
 [C] time, supply and cost  
 [D] quality, cost and supply
- 48.** A typical SCC mix will have slump-flow of around
- [A] 500–700 mm  
 [B] 100–200 mm  
 [C] >1000 mm  
 [D] <100 mm
- 49.** Depreciation, interest paid on capital, rent, salary, property taxes, insurance premium etc. are examples of which type of costs?
- [A] Fixed  
 [B] Variable  
 [C] Direct  
 [D] Indirect
- 50.** The flange of an inverted simply supported T-beam subjected to its self-weight, will be in
- [A] compression  
 [B] tension  
 [C] torsion  
 [D] shear



- 51.** In a built-up compression member made up by two channels back to back placed with each other, the two parts are integrated by the use of
- [A] batten plates
  - [B] connecting rods
  - [C] sag rods
  - [D] gusset plates
- 52.** The function of the column-base is to transmit
- [A] the structure stresses to the concrete footing surface
  - [B] the axial force to the concrete footing surface
  - [C] the bending moment to the concrete footing surface
  - [D] the shear stress to the concrete footing surface
- 53.** The bottom chord of an N-truss, subjected to gravity loads is always subjected to
- [A] axial compression
  - [B] bending moment
  - [C] axial tension
  - [D] shear force
- 54.** The shape factor for a triangular cross-section of base  $B$  and height  $H$  is
- [A] 2.346
  - [B] 3.0
  - [C] 1.5
  - [D] 2.15
- 55.** A phenomenon of rise or fall of liquid surface relative to the adjacent general level of liquid is called
- [A] relative rise
  - [B] capillarity
  - [C] surface fall
  - [D] relative fall
- 56.** Consolidation is the gradual reduction in the volume of a partly or fully saturated soil mainly due to the expulsion of water from the soil pores. This happens under
- [A] variable loading
  - [B] sustained loading
  - [C] cyclic loading
  - [D] random loading
- 57.** The best method to find out the shear properties of a cohesionless soil sample is
- [A] direct shear test
  - [B] unconfined compression test
  - [C] triaxial shear test
  - [D] vane shear test
- 58.** The details of the allowable bearing capacity for foundation design can be worked out after carrying out
- [A] sub-surface surveys
  - [B] geotechnical investigations
  - [C] groundwater surveys
  - [D] geological surveys
- 59.** Standard penetration number of blows have to be corrected using which correction?
- [A] Dilatancy correction
  - [B] Overburden pressure correction
  - [C] Dilatancy correction and Overburden pressure correction
  - [D] Instrumental error correction

60. The parameters  $N_c$ ,  $N_q$ ,  $N_\gamma$  are the dimensionless numbers, known as bearing capacity factors in Terzaghi's theory, depend on
- [A] the angle of shearing resistance  $\phi$  of the soil
  - [B] cohesion value  $c$  of the soil
  - [C] Both [A] and [B]
  - [D] moisture content of the soil
61. The settlement, that results from the time-dependent rearrangement of soil particles under constant effective stress conditions, is
- [A] immediate settlement
  - [B] primary consolidation settlement
  - [C] secondary compression settlement
  - [D] tertiary settlement
62. The velocity, pressure and other flow properties at each point in the fluid remain constant in which type of flows?
- [A] Turbulent flow
  - [B] Critical flow
  - [C] Laminar flow
  - [D] Sub-critical flow
63. When a bluff body is placed in a flowing fluid, the resulting wake zone is
- [A] large
  - [B] moderate
  - [C] small
  - [D] Not produced at all
64. When the flow velocity in a channel is equal to the wave velocity generated by an obstruction, the flow is called
- [A] super-critical flow
  - [B] sub-critical flow
  - [C] critical flow
  - [D] ultra-critical flow
65. A direct runoff hydrograph resulting from one unit of constant intensity uniform rainfall occurring over the entire watershed is called
- [A] hydrological graph
  - [B] hydrograph
  - [C] unit hydrograph
  - [D] hydro unit
66. MBBR and SBR technologies are used for what purpose?
- [A] Water treatment
  - [B] Sewage treatment
  - [C] Effluent treatment
  - [D] Soil treatment
67. Water Quality Index is a value evaluated by what type of function?
- [A] Aggregate function
  - [B] Exponential function
  - [C] Logarithmic function
  - [D] Evaluation function

- 68.** The computation of AQI in India is based on how many pollutants?
- [A] 10  
[B] 8  
[C] 12  
[D] 6
- 69.** Energy recovery from waste is the conversion of non-recyclable waste materials by
- [A] anaerobic digestion  
[B] dehumidification  
[C] emulsification  
[D] dehydration
- 70.** Traffic models that describe the details of traffic flow and the interaction between individual vehicles taking place within it are called
- [A] macroscopic traffic models  
[B] hybrid traffic models  
[C] interactive traffic models  
[D] microscopic traffic models
- 71.** Permanent, longitudinal surface depression that occurs in the wheel paths of a flexible pavement due to the passage of traffic is called
- [A] rutting  
[B] shoving  
[C] bulging  
[D] pitting
- 72.** EDM technology uses which type of waves to measure the distance between the instrument and a handheld reflector?
- [A] Sound waves  
[B] Infra-red waves  
[C] Ultra-violet light waves  
[D] Electromagnetic waves
- 73.** The type of imagery used in remote sensing to capture data is
- [A] aerial imagery  
[B] satellite imagery  
[C] thermal imagery  
[D] acoustic imagery
- 74.** GIS stores location data in
- [A] colored layers  
[B] thematic layers  
[C] thermal layers  
[D] optical layers
- 75.** The rate of change of velocity and the rate of change of momentum of a moving body respectively are
- [A] acceleration and impulse  
[B] acceleration and force  
[C] displacement and force  
[D] force and displacement
- 76.** For economical spacing of roof truss, if  $t$ ,  $p$ ,  $r$  are the costs of truss, purlin and roof coverings respectively, then
- [A]  $t = p + r$   
[B]  $t = 2p + r$   
[C]  $t = p + 3r$   
[D]  $t = p + 2r$

77. The first-moment of area about the axis of bending for a beam cross-section is
- [A] section modulus  
[B] moment of inertia  
[C] shape factor  
[D] polar moment of inertia
78. For a given shear force across a symmetrical I section, the intensity of shear stress is maximum at the
- [A] extreme fibres  
[B] centroid of the section  
[C] junction of the flange and the web, but on the web  
[D] junction of the flange and the web, but on the flange
79. The kinematic indeterminacy of single-bay portal frame fixed at the base is
- [A] 1  
[B] 2  
[C] 3  
[D] 0
80. Workability of concrete can be measured using slump, compaction factor and Vebe time. Consider the following statements for workability of concrete :
- (i) As the slump increases, the Vebe time increases.  
(ii) As the slump increases, the compaction factor increases.
- Which of the following is **true**?
- [A] Both (i) and (ii) are true  
[B] Both (i) and (ii) are false  
[C] (i) is true and (ii) is false  
[D] (i) is false and (ii) is true
81. Which one of the following is categorized as a long-term loss of prestress in a prestressed concrete member?
- [A] Loss due to elastic shortening  
[B] Loss due to friction  
[C] Loss due to relaxation of strands  
[D] Loss due to anchorage slip
82. As per IS 800:2007, the cross-section in which the extreme fiber can reach the yield stress, but cannot develop the plastic moment of resistance due to failure by local buckling is classified as
- [A] plastic section  
[B] compact section  
[C] semi-compact section  
[D] slender section
83. As per IS 10500 : 2012, for drinking water, in the absence of alternate source of water, the permissible limits for chloride and sulphate, in mg/L, respectively are
- [A] 250 and 200  
[B] 200 and 250  
[C] 1000 and 400  
[D] 500 and 1000
84. A PERT network has 9 activities on its critical path. The standard deviation of each activity on the critical path is 3. The standard deviation of the critical path is
- [A] 3  
[B] 9  
[C] 27  
[D] 81

85. Consider the following statements :

- P. Walls of one brick thick are measured in square meters.
- Q. Walls of one brick thick are measured in cubic meters.
- R. No deduction in the brickwork quantity is made for openings in walls up to  $0.1 \text{ m}^2$  area.
- S. For the measurement of excavation from the borrow pit in a fairly uniform ground, deadmen are left at suitable intervals.

For the above statements, the correct option is :

- [A] P-False; Q-True; R-False; S-True
- [B] P-False; Q-True; R-False; S-False
- [C] P-True; Q-False; R-True; S-False
- [D] P-True; Q-False; R-True; S-True

86. The void ratio of a soil sample is 1, the corresponding porosity of the sample is

- [A] 0.5
- [B] 1
- [C] 1.5
- [D] 2

87. A fine-grained soil is found to be plastic in the water content range of 26-45 %. As per Indian Standard Classification System, the soil is classified as

- [A] CL
- [B] CI
- [C] CH
- [D] CL-ML

88. In the consolidated undrained triaxial test on a saturated soil sample, the pore water pressure is zero

- [A] during shearing stage only
- [B] both at the end of consolidation and during shearing stages
- [C] at the end of consolidation stage only
- [D] Under none of the above conditions

89. The two criteria for the determination of allowable bearing capacity of a foundation are

- [A] tensile failure and compression failure
- [B] tensile failure and settlement
- [C] bond failure and shear failure
- [D] shear failure and settlement

90. The group efficiency of pile group will be

- [A] always less than 100%
- [B] always greater than 100%
- [C] more than 100% for pile groups in cohesionless soils and less than 100% for those in cohesive soils
- [D] None of the above

91. For steady incompressible flow through a closed conduit of uniform cross-section, the direction of flow will always be from higher to lower

- [A] elevation
- [B] pressure
- [C] velocity
- [D] piezometric head

92. As per the Lacey's method for design of alluvial channels, identify the **true** statement from the following.

- [A] Wetted perimeter increases with an increase in design discharge
- [B] Hydraulic radius increases with an increase in silt factor
- [C] Wetted perimeter decreases with an increase in design discharge
- [D] Wetted perimeter increases with an increase in silt factor

93. Two air pollution control devices that are usually used to remove very fine particles from the flue gas are  
[A] cyclone and venture scrubber  
[B] cyclone and packed scrubber  
[C] electrostatic precipitator and fabric filter  
[D] settling chamber and tray scrubber
94. A coastal city produces Municipal Solid Waste (MSW) with high moisture content, high organic materials, low calorific value and low inorganic materials. The most effective and sustainable option for MSW management in that city is  
[A] composting  
[B] incineration  
[C] dumping in sea  
[D] landfill
95. Chemical Oxygen Demand (COD) of a sample is always greater than Biochemical Oxygen Demand (BOD) since it represents  
[A] biodegradable organic matter only  
[B] biodegradable and non-biodegradable organic matters  
[C] non-biodegradable organic matter  
[D] inorganic matter
96. In the revised CBR design method recommended by IRC for design of flexible pavement, total thickness depends upon CBR value of soil and  
[A] aggregate ratio  
[B] magnitude of wheel load  
[C] number of commercial vehicles per day  
[D] cumulative standard axle loads
97. An aggregate is said to be exceptionally strong when the aggregate impact value is  
[A] less than 10  
[B] 10 to 20  
[C] 20 to 30  
[D] above 35
98. Correction for temperature in a chain when the temperature at field is more than the standard temperature is  
[A] additive  
[B] negative  
[C] constant  
[D] Not applicable
99. The difference between the most probable value of a quantity and observed value is  
[A] true error  
[B] weighted observation  
[C] conditional error  
[D] residual error
100. The suitable contour interval for a map with scale 1 : 10000 is  
[A] 2 m  
[B] 5 m  
[C] 10 m  
[D] 20 m



**SPACE FOR ROUGH WORK**



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