A BRIEF INTRODUCTION TO THE WRITTEN TEST

The written test is an aptitude examination designed to test your general intelligence and basic understanding of Mathematics, Applied Sciences / Engineering and Analytical/logical thinking. This written test is like GRE Engineering. To help you in preparing for the written test, a brief outline of this test is presented below.

Some of the questions may require numerical calculations, ***so you must bring your own calculator.*** IT MAY BE NOTED THAT WRITING TABLES MAY NOT BE AVAILABLE DURING THE WRITTEN TEST. THEREFORE, ALL CANDIDATES ARE ADVISED TO BRING THEIR OWN WRITING CLIP BOARDS FOR THEIR CONVENIENCE DURING THE WRITTEN TEST.

In order to give you an idea of the nature of the written test, some representative questions are also enclosed.

WRITTEN TEST OUTLINE

The question paper is divided into two parts i.e. Part (A) and (B). There will be 30 questions in Part (A) and 50 Questions in Part (B). Part (A) is the GENERAL PART to be attempted by all the candidates whereas Part (B) is the as per filed/subject chosen by the candidate. The candidate should mention the subject paper he/she is attempting by filling the appropriate section on the answer sheet. The maximum time allowed is 2 hours.

1) General Part: It consists of basic Mathematics, Analytical, Physics and English (Level F Sc. and B.Sc.)

2) Subject Part: It consists of subject/field questions of relevant field (Level: B. Sc. Engineering) .

PAKISTAN ATOMIC ENERGY COMMISSION

ENTRANCE TEST FOR POST GRADATE TRAINING AT CHASCENT AND KINPOE

SUBJECT: (Sample Paper)

NAME: _____

FATHER'S NAME _____

ROLL No._____ Email: _____

CENTRE_____Mobile No._____

SIGNATURE _____

TIME ALLOWED: 02:00 Hours

Instructions:

- *Write your full name and all other information asked at the top of this page and at the* **Answer sheet** *provided.*
- **Encircle the letters A, B, C or D in the Answer Sheet** *corresponding to the correct answer from the given options*
- *Each correct answer carries* **THREE** *marks while* **ONE** *mark will be* **deducted** *for each incorrect answer.*
- *Use of any* **external paper** *for rough work is* **not allowed**. *Carry out your rough work somewhere in the question paper.* **DO NOT** *use any side of the answer sheet for rough work.*
- **More than one** *answers for a single question will be considered as* **INCORRECT**
- *Fill the answer sheet carefully. Avoid overwriting and/or cutting in the answer sheet.*
- ***Exchange of any thing is not allowed*** *during the examination*
- ***STOP WRITING IMMEDIATELY*** *when you are asked to do so*
- ***KEEP YOUR MOBILE PHONES OFF AND POCKETED. USE OF MOBILE PHONE AS CALCULATOR IS ALSO NOT ALLOWED.***
- *Be sure that you have got all pages of your paper with 80 questions in all.*

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Sample Paper (General)

1. The Laplace transform of e^{-2t} is

   (A) 0.5 s (B) 2/(s+1) (C) 1/(s+2) (D) 2/(s+2)

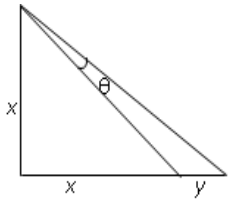
2. Tanθ in the accompanying diagram is

   (A) y/(y+2x)

   (B) x/(y+x)

   (C) y/(y+x)

   (D) y/x



3. By a chord of the curve $y = x^3$ we mean any line joining two distinct points on it. The number of chords which have slope 1 is

   (A) infinite (B) 0 (C) 1 (D) 2

4. The absolute temperature for an ideal gas is

   (A) directly proportional to the rotational K.E. of gas molecules

   (B) directly proportional to vibrational K.E of gas molecules

   (C) directly proportional to average translational K.E of gas molecules

   (D) directly proportional to the P.E of the gas molecules

5. An engineer claims, with some thermodynamic analysis, that if the proposed construction site of a Nuclear power plant is changed from one city to another, Plant efficiency will increase (cost of construction and everything else is same). Does change of city has to do anything with thermodynamic efficiency of plant?

   (A) No

   (B) Yes

   (C) Cannot be determined

   (D) Yes, but only if population difference is negligible

6. A banana has twice the calories than an apple has. Also a hamburger has 1.5 times as many calories as banana. Therefore,

   (A) A hamburger has as many calories as one apple

   (B) A hamburger has 2 times as many calories as one apple

   (C) A hamburger has 3 times as many calories as one apple

   (D) A hamburger has 4 times as many calories as one apple

7. Three pipes A, B and C can fill a tank in 10, 12 and 15 minutes respectively. First A was opened. After one minute B was opened and after two minutes from the start of A, C was opened. Find the time in which the tank is just full.

(A) 4 min,52 sec (B) 3 min (C) 3 min,52 sec (D) 4 min, 06 sec

8. Which number in the series should come next?

-1 0 1 8

(A) 15 (B) 20 (C) 25 (D) 27

9. The pressure P units and the volume V m^3 of a quantity of gas stored at a constant temperature are related by pv=k. At a certain time, the volume of gas in cylinder is 30 m^3 and pressure is 20 units. If the gas is being compressed at the rate of $6m^3$/sec, at what rate is the pressure changing?

(A4units/s increasing (B) 6 units/s increasing

(C) 6 units/s decreasing (D) 4units/s decreasing

10. The manager ---------- everyone go home an hour early on Friday afternoon.

A) allowed
B) let
C) permitted
D) got

Sample Paper (CHEMICAL)

1. Benzene with density (865 kg/m^3) and flow rate (9 m^3/hr) is pumped from a reservoir to another with suction lift 2m and discharge head 5m. Supposing plug flow, calculate power required if pump efficiency is 80 %.

   (A) 15.14 W (B) 18.92 W (C) 12.11 W (D) 20 W

2. For circular tube, hydraulic radius is

   (A) D (B) D/2 (C) D/3 (D) D/4

3. Stokes equation is valid in the Reynolds number range

   (A) 0.01 – 0.1 (B) 0.1 – 2 (C) 2 – 10 (D) 10 – 100

4. Total integrated drag from pressure is called

   (A) wall drag (B) form drag (C) shear drag (D) none of these

5. The reaction in which rate equation corresponds to a stoichiometric equation is called

   (A) elementary reactions (B) non-elementary reactions

   (C) heterogeneous reactions (D) none of these

6. The rate expression for the reaction between H_2 and Br_2 to produce HBR ($H_2 + Br_2 \rightarrow HBR$) is given by.

$$\text{rate} = \frac{k_1[H_2][Br_2]^{1/2}}{k_2 + \frac{[HBr]}{[Br_2]}}$$

   The reaction is

   (A) stoichiometric (B) fundamental (C) elementary (D) non-elementary

7. A fluid with viscosity 0.4 Pascal-sec is placed between two plates which are 0.02 m apart. The upper plate is moving with velocity 2 m/s and the lower plate is stationary. Find the velocity at y=0.015 if V=0 at y=0 for linear velocity profile.

   (A) 1 m/s (B) 1.5 m/s (C) 2 m/s (D) 1.25 m/s

8. A 35% Na_2So_4 solution in water is fed to a crystallizer. The product stream contains hydrated crystals $Na_2So_4.10H_2O$ in equilibrium with a 20Wt% Na_2So_4 solution. The feed rate of 35%solution required to provide 500 Kg of hydrated crystals is

   (A) 403 Kg/hr (B) 603 Kg/hr

   (C) 803 Kg/hr (D) 1103 Kg/hr

9. The maximum depth from which a centrifugal pump can draw water

(A) dependent on speed N of the pump

(B) dependent on the power of the pump

(C) 34 feet

(D) 150 feet

10. A 120 cm pipe is in series with a 60 cm pipe. The rate of flow of water in the system of pipes is 2 m^3/s. What is the velocity of flow in each pipe?

(A) V_{120}= 2 m /s and V_{60}= 6 m /s

(B) V_{120}= 6 m /s and V_{60}= 2 m /s

(C) V_{120}= 2 m /s and V_{60}= 2 m /s

(D) V_{120}= 1.77 m /s and V_{60}= 7.08 m /s

Sample Paper (ELECTRICAL)

1. A sinusoidal voltage with equation V_m=sin 314 t is applied across a load and the current lags behind the voltage by 30 degrees. Which of the following is NOT correct?

(A) The load is inductive in nature

(B) No power will be consumed in the circuit

(C) The frequency of the current will be the same as that of the voltage

(D) Power factor of the circuit will have a value less than 1.0

2. Which of the following is not the function of transformer oil?

(A) Cooling the primary coil

(B) Cooling the secondary coil

(C) Providing additional insulation

(D) Providing inductive coupling

3. Over voltage transient may occur in a transmission line due to

(A) Lightening

(B) Switching

(C) Arcing ground

(D) Any of the above

4. Which of the following statements is not correct for a pure inductive circuit?

(A) The power factor of the circuit is zero

(B) The power consumed in the circuit is zero

(C) The instantaneous power in the circuit can have any value positive, negative or zero

(D) All of the above statements are true for a pure inductive circuit

5. A transmitting aerial is radiating un-modulated carrier, the radiated power being 1200 W. If the carrier is now modulated simultaneously by two pure notes to depth of 20% and 40% respectively, the total power radiated will now be

(A) 1320 W (B) 1200 W (C) 1180 W (D) 920 W

6. If the e.m.f. in the rotor of a three pole induction motor has a frequency of 1.5 Hz and that in the stator is 50 Hz. What is the speed at which the motor is running?

(A) 750 rpm
(B) 744 rpm
(C) 727.5 rpm
(D) 713.5 rpm

7. Which method of starting an induction motor is expected to take largest starting current.

(A) Direct on-line starting
(B) Stator rotor starting
(C) Star-delta starting
(D) Auto-transformer starting

8. The back e.m.f. set up in the stator of a synchronous motor will depend upon

(A) Rotor speed only
(B) Rotor excitation only
(C) Rotor excitation and rotor speed
(D) Coupling angle, rotor speed and excitation

9. An alternator is generating power at 210 V per phase while running at 1500 rpm. If the speed of an alternator drops to 1000 rpm the generated voltage per phase will be

(A) 180 V
(B) 150 V
(C) 140 V
(D) 105 V

10. The driving power from the prime-mover driving the alternator is lost but the alternator remains connected to the supply network and the field supply also remains on. The alternator will

(A) Get itself burnt
(B) Behave as an induction motor but will rotate in opposite direction
(C) Behave as a synchronous motor and will rotate in the same direction
(D) Behave as a synchronous motor but will rotate in a reverse direction to that corresponding to generator action

Sample Paper (CIVIL)

1. In a two hinged arch, an increase in temperature induces

(A) No bending moment in the arch rib

(B) Uniform bending moment in the arch rib

(C) Uniform bending moment in the arch rib

(D) Minimum bending moment at the crown

2. Poisson's Ratio for Concrete is approximately

(A) 0.625 (B) 0.534 (C) 1.325 (D) none of these

3. The field of mechanics concerned with the study of propagation of cracks in materials is known as

(A) Statics (B) Dynamics

(C) Fracture Mechanics (D) Metal Mechanics

4. Which of the following Test fall in the category of Non-Destructive Testing?

(A) X-ray (B) Laser Ultrasonics

(C) PT & LT (D) All of these

5. From a nozzle exposed to atmosphere the liquid jet traverses:

(A) Straight path (B) Parabolic path

(C) Circular path (D) Elliptical path

6. Soils exhibit strain-dependent dynamic properties so that as earthquake strong shaking increases, soil shear modulus

(A) increases (B) decreases

(C) remain the same (D) may increase or decrease

7. The ratio of the tensile stress developed in the walls of a boiler in the circumferential direction to the tensile stress in the axial direction is

(A) 4 (B) 3 (C) 2 (D) 1

8. The point of contra flexure occurs in

(A) cantilever beam only (B) continuous beam only

(C) overhanging beam only (D) simple beam only

9. A rectangular beam 20cm wide is subjected to maximum shearing force of 10,000 kg, the corresponding maximum shearing stress being 30 kg/cm^2.The depth of the beam is

(A) 15 cm (B) 20 cm (C) 25 cm (D) 30 cm

10. To a cyclist riding west at 20 kg/hr, the rain appears to meet him at an angle of 45° with the vertical. When he rides at 12 km/hr, the rain meets him at an angle of 19°48' with the vertical. The actual direction of the rain is

(A) 13° (B) 21° (C) 31° (D) 70°

Sample Paper (ELECTRONICS)

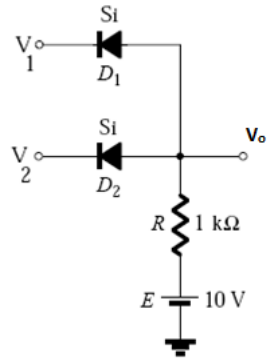
1 A diode that has a negative resistance characteristic is the

(A) Schottky diode (B) PIN diode
(C) Laser diode (D) Tunnel diode

2 A given BJT has a beta (β) rating of 400, the value of alpha (α) for this device is;

(A) 1.0025 (B) 0.0025
(C) 0.9975 (D) 1.00

3 For positive logic following is an ;



(A) NAND Gate (B) AND Gate
(C) OR Gate (D) XOR

4 In a Darlington pair configuration, each transistor has an ac beta of 125. If R_E is 560Ω, the input resistance is;

(A) 560 Ω (B) 70 kΩ
(C) 140 kΩ (D) 8.75 MΩ

5 The number of poles in a filter affect the

(A) voltage gain (B) bandwidth
(C) centre frequency (D) roll-off rate

6 The unit of magnetic charge is

(A) Amperes (B) Ampere-meter
(C) Ampere-meter square (D) Coulombs

7 A Wein bridge oscillator has R1=R2=220 KΩ, and C1=C2=250pF, The frequency of oscillation will be nearly;

(A) 0.89 KHz (B) 1.89 kHz
(C) 2.89kHz (D) 3.89kHz

8 To calibrate a pressure transmitter, with a range of 0 psi to 600 psi, to 0.02% of reading accuracy, which of the following test equipment would be best suited for the calibration?

(A) Precision dial gage. (B) Precision dead weight tester.
(C) High pressure mercury manometer. (D) Precision air piston.

9 A certain fiber-optic cable has the following characteristics: n1 = 1.82 and n2 = 1.73. What is the value of θc?

(A) 1.0^o (B) 0.95^o
(C) 1.81^o (D) 18.1^o

10 8086 is a 16-bit microprocessor having;

(A) 4 bit data bus (B) 8 bit data bus
(C) 16 bit data bus (D) 32 bit data bus

Sample Paper (MECHANICAL)

1. In a wind tunnel the flow speeds (of air) on the upper and lower surfaces of the wing of a model airplane are v_1 and v_2 respectively ($v_1 > v_2$). If the wing area is A and the density of air is ρ, the lift on the wing is

(A) $\rho\ (v_1^2 - v_2^2)A$ (B) $\frac{1}{2}\rho\ (v_1 - v_2)A$ (C) $\frac{1}{2}\rho\ (v_1^2 - v_2^2)A$ (D) $\frac{1}{2}\ (v_1^2 - v_2^2)A/\rho$

2. Oil has a kinematic viscosity of 1.25×10^{-04} m^2/s and a specific gravity of 0.8. What is dynamic (absolute) viscosity of the oil?

(A) 0.08 kg/m- (B) 0.10 kg/m- (C) 0.125 kg/m- (D) 1 kg/m-s

s s s

3. In flow through a straight, smooth pipe, the diameter Reynolds number for transition to turbulence is generally taken to be

(A) 1500 (B) 2300 (C) 250,000 (D) 4000

4. Consider a liquid with density ρ, viscosity μ and velocity V flowing over a very small dam spillway of length L, such that surface tension coefficient σ is very important. The quantity $\rho V^2 L/\sigma$ in this case is important and is called

(A) Weber number (B) Froude number

(C) Prandl number (D) Bond number

5. Minor losses through pipes, fitting, bend etc. are commonly modeled as proportional to:

(A) Velocity Head (B) Static Head (C) Total Head (D) Pressure Drop

6. What is hydraulic diameter of rectangular air conditioning duct whose cross section is 1 m by 25 cm?

(A) 40 cm (B) 50 cm (C) 75 cm (D) 100 cm

7. Stress intensity factor 'K_I', has the following relationship with the crack length 'a' in a material

(A) K_I α a (B) K_I α $\sqrt{a}$ (C) K_I α $\frac{1}{\sqrt{a}}$ (D) K_I α a^2

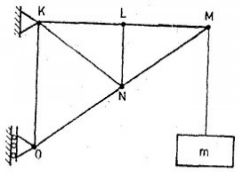
8. The figure shows a pin-jointed plane truss loaded at the point M by hanging a mass of 100 kg. The member LN of the truss is subjected to a load of?

(A) 0 Newton

(B) 490 Newton in compression

(C) 981 Newton in compression

(D) 981 Newton in tension



9. The automobile exhaust will have maximum of hydrocarbons when the vehicle is

(A) Idling (B) Cruising (C) Decelerating (D) Accelerating

10. The efficiency of vapor power Rankine cycle can be increased by

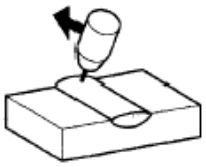
i. Increasing the temperature of the working fluid at which heat is supplied
ii. Increasing the pressure of the working fluid at which heat is supplied
iii. Decreasing the temperature of the working fluid at which heat is rejected

Which of the above statements is/are correct?

(A) i alone (B) ii and iii (C) i, ii and iii (D) i and ii

Sample Paper (MATERIALS/ METALLURGY)

1) A material has better mechanical properties if it has
   A) Elongated grains
   B) Coarse equiaxed grains
   C) Coarse grains with twinned structure
   D) Fine equiaxed grains
2) Crystal structure of martensite is
   A) Body Centered Cubic (BCC)
   B) Face Centered Cubic (FCC)
   C) Body Centered Tetragonal (BCT)
   D) Hexagonal Close packed (HCP)
3) A crystallographic direction common to two or more planes is called
   A) Axis of symmetry
   B) Zone axis
   C) Close packed direction
   D) Axis of superposition
4) Liquid $\rightarrow \alpha + \beta$ is a
   A) Monotectic reaction.
   B) Peritectic reaction.
   C) Eutectic reaction.
   D) Eutectoid reaction.
5) Phase diagram does not tell about the
   A) Phases present
   B) Composition of a particular phase
   C) Relative proportion of phases
   D) Phase morphology
6) Strength of an Al alloy _____ with increase in aging time.
   A) First increases and then decreases
   B) Always increases
   C) First decreases then increases
   D) Always decreases
7) Which one is austenite stabilizer
   A) Cr
   B) Cu
   C) Mo
   D) Mn
8) Steel making is
   A) An oxidizing process
   B) A reducing process
   C) A duplex process
   D) A neutral process
9) Smelting of iron is carried out under
   A) Oxidizing conditions
   B) Reducing conditions
   C) Neutral conditions
   D) None of the above
10) Welding position shown on right is
   A) Forehand position
   B) Backhand position
   C) Vertical position
   D) Overhead position



Sample Paper (MECHATRONICS)

1. In robotics, reverse kinematics is used
   a. to determine the joint parameters that provide a desired position of the end-effector
   b. to determine a desired position of end-effector using the joint parameters
   c. to determine the location of both end-effector and joint position
   d. none of the above

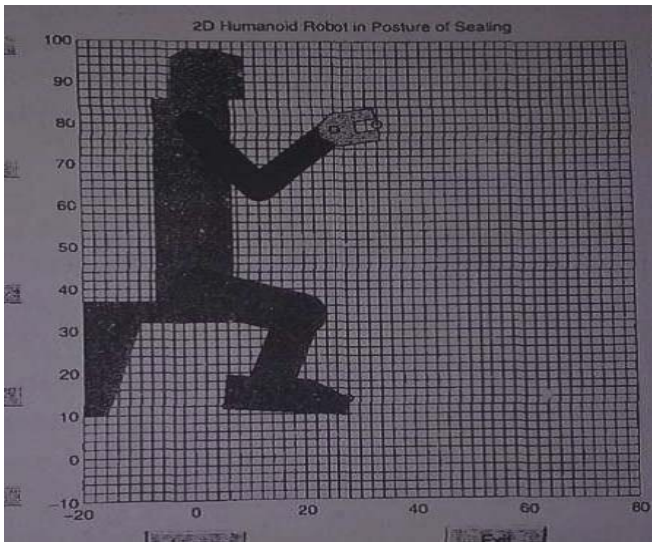
2. A robot in Cartesian space has _____ degree of freedom
   a. 2
   b. 3
   c. 6
   d. none of the above

3. The Laplace Transform of the unit-ramped function is
   a. 1
   b. 1/s
   c. $1/s^2$
   d. $1/s^3$

4. The language most suitable for writing complex control functions is
   a. Ladder
   b. Functions blocks
   c. Statement listing
   d. Sequence programs

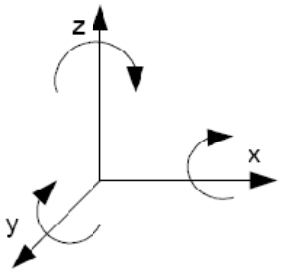
5. The speed (in rpm) of an *ac* generator with 24 poles, with a frequency of 50 Hz is
   a. 300
   b. 250
   c. 200
   d. 150

6. Figure shows the simulated humanoid robot in a seated position, where the right arm and right leg can be treated as two independent manipulators. The right arm is treated as a simple open kinematic-chain with the upper body as its base link. The lengths of the upper link(link-1), lower link(link-2) and hand link (link-3) of the right arm are 20cm, 20cm and 8cm respectively. The origin of the base links frame (frame 0) is at (0,80cm)in the world frame. If the input of the joint angles are q_1 = 37.5^o, q_2=98.5^o, q_3 = 36° then find out the origin of the hand link's frame with respect to the world frame.



   a. x = 30cm, y = 80cm
   b. x = 33.9469cm, y = 79.9089cm
   c. x = 40cm, y = 90cm
   d. x = 31.5cm, y = 80cm

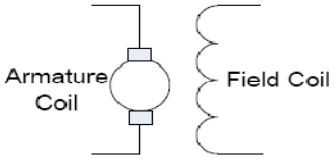
7. A body that is free in space can move in three, independent, mutually perpendicular directions and rotate in three ways about those directions as shown in figure. It is said to have that body have:



   a. 3 degree of freedom
   b. 6 degree of freedom

c. 9 degree of freedom
d. 12 degree of freedom

8. Figure shows the DC motor with field coils. This arrangement is classified as



a. Series wound motor
b. Shunt wound motor
c. Separately excited motor
d. Compound wound motor

9. Natural Frequency of Transverse Vibration of the beam (Neglecting the self weight of the beam) can be expressed as:

a. $\omega_n = (mk)^{1/2}$
b. $\omega_n = (k/m)^{1/2}$
c. $\omega_n = (k/m)^2$
d. $\omega_n = (k.m)$

10. A metal block, placed on a rough surface, is attached to a spring and is given an initial displacement of 10cm from its equilibrium position .After 5 cycles of oscillations in 2 sec, the final position of the metal block is found to be 1 cm from its equilibrium position. Find the coefficient of friction between the surface and the metal block

a. $\mu = 0.11$
b. $\mu = 0.22$
c. $\mu = 0.1132$
d. $\mu = 0.2232$

Sample Paper (Computer Engineering)

1. The CPU structure contains:
a. Cache, ALU, Control Unit and Control Memory
b. System Bus, ALU, Control Unit and Registers
c. Memory, ALU, Control Unit and Cache
d. Registers, ALU, Internal CPU Interconnection and Control Unit

2. Normally, the FPGA resources are used less than 70% because:
a. Routing becomes excessively complicated
b. Power issues
c. Clock frequency
d. Simulation time increases

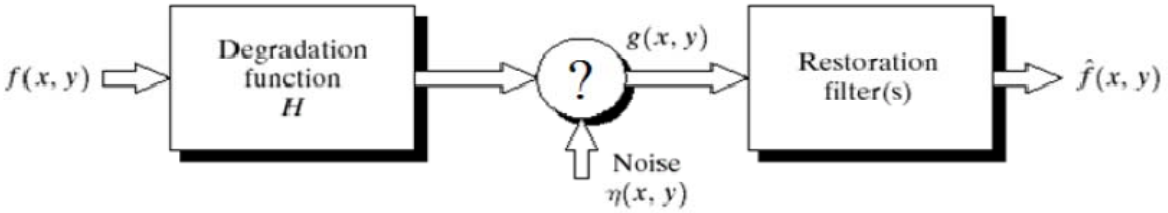
3. In which layer Telnet and FTP works?
a. Application
b. Session
c. Network

4. If b=2'b10 and c={2'b01,{b,b}}, then:
a. c = 6'b011010;
b. c = 6'b101010;
c. c = 6'b111111;
d. c = 6'b001100;

5. Which of the I/O structure steals memory cycles from CPU and slows down CPU execution during its operation?
a. Synchronous
b. Asynchronous
c. Direct Memory access
d. Symmetric

6. A binary image is encoded using run length code row by row, with “0” represents white, and “1” represents black. What will be code for row 10 in diagram given below?
a. “0”, 7, 2, 7
b. “1”, 3, 10, 3
c. “0”, 2, 1, 10, 1, 2
d. “0”, 3, 2, 6, 3, 2

7. What is represented by the question mark symbol?



a. –
b. +
c. /
d. ×

X11YZ

8. Which protocol works at the Internet layer and provides a connection service between hosts?

a. IP
b. ARP
c. TCP
d. UDP

9. How long does it take to send a file of 640,000 bits from host A to host B over a circuit-switched network?

- ✓ All links are 1.536 Mbps
- ✓ Each link uses TDM with 24 slots/sec
- ✓ 500 msec to establish end-to-end circuit

a. 7.5 sec
b. 8.5 sec
c. 9.5 sec
d. 10.5 sec

10. Which of the following function prototype is perfectly acceptable?

a. int Function(int Tmp = Show());
b. float Function(int Tmp = Show(int, float));
c. Both A and B.
d. float = Show(int, float) Function(Tmp);

11. Which of the following are valid calls to *Math.max*?

1. Math.max(1,4)
2. Math.max(2.3, 5)
3. Math.max(1, 3, 5, 7)
4. Math.max(-1.5, -2.8f)

a. 1, 2 and 4
b. 2, 3 and 4
c. 1, 2 and 3
d. 3 and 4

12. What will be the output of the program?

```
String x = new String("xyz");
String y = "abc";
x = x + y;
```

How many String objects have been created?

a. 2
b. 3
c.4
d.5