**LUMS PSIFI EVALUATION FORM**

Q1) As you fall down a well, your weight:

1. Increases slightly
2. Decreases slightly
3. Remains the same

Q2) A cannon, placed on a horizontal plane, fires a projectile with an initial velocity of 15.7 m/s at an angle of 50˚ to the horizontal. There is also a wind blowing at 5 m/s in the direction opposite the motion of the projectile. Stating your value for the acceleration of gravity, find the maximum distance that the projectile will travel above and along the plane.

Q3) A scientist was killed in his laboratory. The police found a paper saying 'Sodium, Titanium", near the dead body. The police suspect suicide, the scientist's assistant Marc, his ex-wife Tina, and his daughter Sophie. Who was the killer?

Q4) You are tasked with designing the communication centers in a space settlement, as such where will you place your main hub

1. Below the ground inside the residential torus
2. Above the ground inside the residential torus
3. In the docking area
4. In the non-rotating section of the settlement

Q5) In a space settlement you have been tasked with collecting the inventory for 16000 people, what product will you prioritize transportation from earth?

1. Non-perishable fruits
2. Processed foods
3. Clothing
4. Water

Q6) Mrs Smith is left to bleed to death in an abandoned amusement park. The morning after her murder, she is found dead tied to a chair. In her last moments, Mrs Smith was able to untie only one hand and wrote some random letters and the word ‘wedding' on the floor in her own blood.

In the follow up investigation, Mr Smith gets called in by the police to explain any significance of the gibberish. After looking at it for 3 minutes, he claims he couldn't make any sense of the message. The next day, the murderer is caught.

Here are three facts about Mr and Mrs Smith:

1) They got married on July 7, 1977

2) They had 634 guests on their wedding

3) Their wedding took place in Ireland

This is what was written on the floor in blood:

PUZWILUZAVRLS

Wedding

1. Decode the message.
2. Why did Mrs Smith leave a code?
3. Why did the husband leave the investigation room without revealing anything?
4. Who is the murderer

(Hint: Cesar cipher)

Q7) At an altitude of approximately 400 km above the Earth, a bored astronaut is sitting inside a space station. In his boredom he decides to grab his space suit and venture outside. After he is outside the station, he stares down at the Earth beneath him. He decides to throw an object at it. The astronaut positions himself firmly on one of the space station’s walls so he doesn’t lose control of himself in zero gravity. He takes out a metallic sphere the size of a tennis ball and, as hard as he can, throws it down at the Earth beneath him. “I hope it hits someone on the head”, he says to himself as the ball rapidly accelerates towards the Earth. The astronaut goes back inside. About an hour later, while eating lunch, the astronaut looks out the window. To his shock, he sees the ball he threw towards the Earth coming back up towards the space station. Baffled, the astronaut starts to wonder why the metallic ball is seemingly defying the laws of physics. Give a one sentence answer as to why the ball is behaving so strangely.

Q8) You have a remote-control jeep in which you have to add a functionality that when it approaches a water body it turns on a led, buzzer and stops driving further if the depth of water exceeds than 2cm of water.

You can’t use microcontrollers, sensors or complex components.

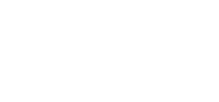
However, you will find it helpful to use

* Transistors
* Relays
* Led
* Resistors
* Buzzer

Design and explain a circuit to add this functionality using appropriate symbols. Also specify the power ratings in the circuit. (Hint: Use the fact that the water is conductive and will complete the circuit if 2 wires are submerged in it)

Note: Treat the Jeep Driving Circuit separate (i.e. you don’t need to draw it, just represent it with a box) which is turned on or off by a relay

Q9)

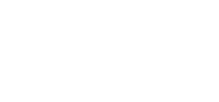


**START**



**1000**

**mm**



**F**

**INISH**



**1000**

**mm**

**1000mm 1000mm**

Consider a robot car (20mmx20mm) having mounted 3 Ultra Sonic sensors on the front and the 2 sides, right and left respectively. An ultrasonic sensor measures the distance between where the sensor is mounted, till the point it encounters an object **DIRECTLY** in front of it and gives the value as an input. Write an algorithm which allows the car to navigate through the track shown above.

Note: All relevant components have been attached, and your answer does not need to talk about the car but only the logic.