Module 3: Graded Quiz

LATEST SUBMISSION GRADE

100%

1. Which of these statements are true? Select any/all that apply:

   1 / 1 point

   ☑ Every set of Euler angles corresponds to a unit quaternion.

   > ✓ **Correct**
   >
   > Correct! Any set of Euler angles represents a rotation which can also be represented by a unit quaternion.

   ☑ Every unit quaternion has an associated 3x3 rotation matrix.

   > ✓ **Correct**
   >
   > Correct! Every quaternion corresponds to a 3x3 rotation matrix.

   ☐ Every 3x3 matrix represents a 3D rotation.

2. Which of these are valid rotation matrices? Select any/all that apply:

   2 / 2 points

   ☑ $C_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

   > ✓ **Correct**
   >
   > Correct! Since C_1 is an identity matrix, it is equivalent to performing "zero" rotation.

   ☑ $C_2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ 0 & -\frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{bmatrix}$

   > ✓ **Correct**
   >
   > Correct! $C_2 C_2^T = \mathbf{I}$ holds and $\det C_2 = 1$.

   ☐ $C_4 = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

☐ $C_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \\ 0 & \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} \end{bmatrix}$

3. Localization can be performed on board a vehicle by integrating the rotational velocities and linear accelerations measured by an IMU. Assuming that the IMU measurement noise is drawn from a normal distribution, what will the pose estimation error look like?

1 / 1 point

◉ The vehicle pose estimation error will grow with time.

◯ The vehicle pose estimate error will remain within a bounded interval.

◯ The vehicle pose estimate error will decrease with time.

✓ **Correct**
Correct! Since we are integrating noisy measurements, the error will build up over time.

4. Each GPS satellite transmits a signal that encodes:

1 / 1 point

◯ The receiver's position and time of signal transmission

◉ The satellite's position and time of signal transmission.

✓ **Correct**
Correct! This information can be used to calculate the vehicle's position.

5. Which of these systems provides the most accurate positioning measurement?

1 / 1 point

◉ RTK GPS

◯ GPS

◯ DGPS

✓ **Correct**
Correct! RTK uses phase of the GPS carrier signal to provide centimetre-level accuracy.

6. What is the minimum number of GPS satellites required to estimate the 3D position of a vehicle through trilateration?

2 / 2 points

4

✓ **Correct**
Correct! A minimum of four satellites is required to unambiguously calculate the vehicle's 3D position.