INSTRUCTIONS:
Fill out the hazard analysis and risk assessment below.
HA-001 should be for the lane departure warning function as discussed in the lecture.
HA-002 should be for the lane keeping assistance function as discussed in the lecture.
Then come up with your own situations and hazards for the lane assistance system. Fill in the HA-003 and HA-004 rows.
When finished, export your spreadsheet as a pdf file so that a reviewer can easily see your work.

Hazard ID	Situational Analysis						
	Operational Mode	Operational Scenario	Environmental Details	Situation Details	Other Details (optional)	Item Usage (function)	Situation Description
HA-001	OM03 - Normal Driving	OS03 - Highway	EN01 - Normal conditions	SD02 - High speed	Day time + Obstacle on the road	IU01 - Correctly used	Normal driving on a highway during normal conditions with high speed
HA-002	OM03 - Normal Driving	OS02 - Country Road	EN01 - Normal conditions	SD02 - High speed	Day time + Obstacle on the road	IU02 - Incorrectly used	Normal driving on country roads during normal conditions with high speed (the driver is misusing the lane keeping assistance function as an autonomous function)
HA-003	OM03 - Normal Driving	OS09 - Road tunnel	EN01 - Normal conditions	SD02 - High speed	Day time + Oncoming vehicle on the next lane	IU01 - Correctly used	Normal driving on tunnel during normal conditions with high speed (At the end when exiting the tunnel)
HA-004	OM03 - Normal Driving	OS05 - Mountain Pass	EN01 - Normal conditions	SD02 - High speed	Day time + High temperature + Upcoming curve + No side guard	IU01 - Correctly used	Normal driving on the mountain pass during normal conditions with high speed (Curvy road is at the cliff)

Hazard ID	Hazard Identification					
	Function	Deviation	Deviation Details	Hazardous Event	Event Details	Hazardous Event Description
HA-001	Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV04 - Actor effect is too much	The LDW function applies an oscillating torque with very high torque (above limit)	EV00 - Collision with other vehicle	High haptic feedback can affect driver's ability to steer as intended. The driver could lose control of the vehicle and collide with another vehicle or with road infrastructure	Driver lose control of steering wheel due to severe vibration
HA-002	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in the lane	DV03 - Function always activated	There was a section of road lane missing so the LKA function does not find the lane	EV00 - Collision with other vehicle	A driver takes both hands off of the steering wheel and treats the vehicle as if it were autonomous	Vehicle suddenly lose control due to the environment where LKA does not work
HA-003	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in the lane	DV13 - Sensor sensitivity is too low	Camera sensor temporarily freezes due to high luminous intensity	EV00 - Collision with other vehicle	A camera with low sensitivity fails at the high sunlight intensity when exiting a tunnel	Vehicle suddenly lose control due to the camera sensor failure
HA-004	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in the lane	DV07 - Actor action too late	Power steering ECU temporarily malfunction due to high temperature, providing delayed messages	EV04 - Car comes off the road	Power steering delay causes late torque applied to stay in the lane at a steep curve road at a cliff, causing the car comes off the road and fall off at the cliff	Vehicle deviates off the road due to the ECU malfunction

Hazard ID	Hazardous Event Classification						Determination of ASIL and Safety Goals	
	Exposure	Rationale	Severity	Rationale	Controllability	Rationale	ASIL	Safety Goal
HA-001	E3 - Medium probability	Vibration from high torque value may occur almost every time LDW function delivers deviation message.	S3 - Life-threatening or fatal injuries	On highway speed of vehicle is expected to be high	C3 - Difficult to control or uncontrollable	It highly depends on the torque value, but most drivers shall be able to control the situation by applying brakes.	C	Prevent collision
HA-002	E2 - Low probability	The combination of misusing the LKA and driving on a country road probably does not happen often.	S3 - Life-threatening or fatal injuries	On country roads speed of vehicle is expected to be high	C3 - Difficult to control or uncontrollable	Because hands aren't on the wheel at high speeds, a vehicle accident would not be controllable.	B	Prevent collision
HA-003	E3 - Medium probability	Although tunnels are not very common in many countries, it could be part of repeating route for drivers in transportation services in some countries.	S3 - Life-threatening or fatal injuries	Although usually the speed limit of tunnels is lower, they are part of highway and the speed is still higher than non-highway roads.	C2 - Normally controllable	While drivers shall be able to control the situation by applying brakes or frowning eyes, it is probably difficult for some drivers to respond because sudden luminous intensity change will not just affect camera but also human eyes without sunglasses.	B	Prevent collision
HA-004	E1 - Very low probability	It's very rare any road adjacent to a cliff doesn't have guard and ECU fails at the same time.	S3 - Life-threatening or fatal injuries	Although usually the speed limit of mountain pass is lower, they are considered as country road and the speed is still expected to be relatively high.	C2 - Normally controllable	Most drivers shall be able to control the situation but only if they were paying a close attention. It is still likely significant percentage of people will be unable to react to such an rare occasion.	QM	Prevent car comes off the road