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	Function	Deviation
HA-001	OM03 – Normal driving	OS04 – Highway	EN06 – Rain (slippery road)	SD02 – High speed		IU01 – Correctly used	Normal driving on a highway during rain (slippery road) with high speed and correctly used system.	Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	DV04 – Actor effect is too much
HA-002	OM03 – Normal driving	OS03 – Country road	EN01 – Normal conditions	SD02 – High speed		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)	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV03 – Function always activated
HA-003	OM03 - Normal driving	OS03 - Country Road	EN06 - Rain (slippery road)	SD04 - High acceleration		IU01 - Correctly used	Normal driving on country roads during rain with high acceleration (after a bend) and correctly used system.	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV07 - Actor action too late
HA-004	OM03 - Normal driving	OS03 - Country Road	EN01 - Normal conditions	SD02 - High speed		IU01 - Correctly used	Normal driving on country roads during normal conditions with high speed and correctly used system.	Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane	DV13 - Sensor sensitivity is too low

Hazard Identification				Hazardous Event Classification				
Deviation Details	**Hazardous Event (resulting effect)**	**Event Details**	**Hazardous Event Description**	**Exposure (of situation)**	**Rationale (for exposure)**	**Severity (of potential harm)**	**Rationale (for severity)**	**Controllability (of hazardous event)**
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.	The LDW function applies too high an oscillating torque to the steering wheel (above limit).	E3 - Medium probability	Rain is something that does not happen daily but occurs once a month or more often.	S3 - Life-threatening or fatal injuries	A collision with another vehicle at high speed can lead to life-threatening (survival uncertain), fatal injuries	C3 - Difficult to control or uncontrollable
As the function is always on, the driver can misuse the function by taking both hands off the wheel and incorrectly treating the car as a fully autonomous vehicle.	EV00 – Collision with other vehicle	When the system is not able to work properly (e.g. sudden loss of road marking) the driver is not able to take over the vehicle in time. The vehicle can then collide with another vehicle or with road infrastructure.	As the function is always on, the driver can misuse the function by taking both hand off the wheel and thus the driver is unable to take over the vehicle in time.	E2 - Low probability	The combination of driving on a country road and misusing the system does not happen often.	S3 - Life-threatening or fatal injuries	A collision with another vehicle at high speed can lead to life-threatening (survival uncertain), fatal injuries	C3 - Difficult to control or uncontrollable
The steering wheel torque that should act in the bend to keep the vehicle in the lane is applied too late (after the bend).	EV00 - Collision with other vehicle	The steering torque is applied too late and causes the vehicle to leave the ego-lane and collide with another vehicle.	The steering torque is not applied during a bend but after it which causes the vehicle to exit the ego-lane.	E3 - Medium probability	Rain is something that does not happen daily but occurs once a month or more often.	S3 - Life-threatening or fatal injuries	A collision with another vehicle at high speed can lead to life-threatening (survival uncertain), fatal injuries	C3 - Difficult to control or uncontrollable
The driver steering torque sensor shows a value that is below the actual driver steering torque (e.g. the indicated value is only 5% of the actual torque)	EV00 - Collision with other vehicle	Due to the indicated driver steering torque that is too low, the electronic power steering ECU demands steering torque that is too high. This causes the vehicle to leave the ego-lane and collide with another vehicle.	The driver steering torque sensor indicates a wrong (too low) value of the actual driver steering torque. Thus the electronic power steering ECU demands a wrong (too high) support torque. The wrong steering torque can cause the vehicle to leave the ego-lane.	E4 - High probability	Driving on country roads under normal conditions is something that occurs during almost every drive.	S3 - Life-threatening or fatal injuries	A collision with another vehicle at high speed can lead to life-threatening (survival uncertain), fatal injuries	C3 - Difficult to control or uncontrollable

	Determination of ASIL and Safety Goals	
Rationale (for controllability)	**ASIL Determination**	**Safety Goal**
Less than 90% of drivers are not able to maintain control over the vehicle, when a to high torque or frequency is applied to the steering wheel.	C	The oscillating torque to the steering wheel from the lane departure warning function shall be limited.
Because the driver's hands are not on the steering wheel at high speeds, a vehicle accident would not be controllable.	B	The lane keeping assistance function shall be time limited and the additional steering torque shall end after a given time interval so that the driver cannot misuse the system for autonomous driving.
The combination of curvy country roads, a too late steering torque and wet roads can cause the driver to loose control over the vehicle.	B	The electronic power steering ECU shall check that the actual provided steering torque is only a few ms behind the demanded torque. If the actual torque is provided too late the steering support torque shall end.
The combination of curvy country roads, high speed and a steering torque, that is too high can cause the driver to loose control over the vehicle.	D	The electronic power steering ECU shall check whether the indicated driver steering torque from the sensor is plausible (e.g. with a model based approach). If the indicated driver steering torque is not plausible the support torque shall end.