## SENSURVEILEDNING

| **Emnekode og navn:**<br>PSYPRO4412 | **Semester / År / Eksamenstype:**<br>H20, hjemmeeksamen, 4 timer |
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**Oppgave:**

Står under eksamenskrav

**Relevant pensumlitteratur:**

**Eksamenskrav:**

# Long questions (Choose two of three, each counts as 40% of the final grade)

**Question 1:** Hva slags impulsivitet er det? Har forskjellene betydning i den virkelige verden?

What kinds of impulsivity are there? Do the distinctions matter in the real world?

**Sensorveiledning**: Wiecki et al. list four kinds of impulsivity. The better students may notice something Wiecki et al did not mention: temporal or delay discounting, reward sensitivity and speed accuracy trade-offs apply to decisions with outcomes that are delayed over a wide range of time intervals, from less than a second to centuries. Failures of inhibition apply to responses typically less than a second delayed.

Caswell et al. initially describe three kinds of impulsivity, and their factor analysis indicates there are four. Two of these are also in Wiecki et al.'s list, a further two are different, but not precisely specified. The pensum thus describes six kinds of impulsivity, of which four are clearly explained:

1) Temporal discounting (what Caswell et al. call temporal impulsivity) is treating events as less important the more they are delayed. The standard procedure to estimate temporal discounting is to offer a choice between one fixed and once variable amounts, at one fixed and one variable delay. For example, offered a choice between two new 100 kr bank notes right now, one should be indifferent between the two. Next, offer 100kr tomorrow, and vary the alternative amount offered right now until finding the indifference point, say 90 kr. Then offer 100 kr in two days, and again find what amount is subjectively worth the same if paid immediately, say 82 kr. That variable amount indicates how much the 100 kr are worth at the delay that has been specified. The steeper that temporal discounting is (the more subjective value declines with delay), the greater the preference

for an immediate over a delayed reward. Steep temporal discounting is one of the kinds of impulsivity associated with ADHD, and with nicotine use.

2) Reward sensitivity refers to how much people are motivated by positive as opposed to negative outcomes. It can be measured by learning tasks involving gains and losses, and checking to what extent choices are explained by memory for either gains or losses. Greater sensitivity for losses is associated with the negative symptoms of schizophrenia, greater sensitivity for gains with pathological gambling, and with ADHD. Reward sensitivity is not one of the four factors identified by Caswell et al.

3) Speed accuracy trade-offs occur in sequential sampling tasks in which people can choose how much data they sample before making a decision. Because the rate at which data become available is not, or not entirely, available under one's own control, gathering more data takes more time. That forces a trade-off between speed, a fast decision relying on les data, and accuracy. Examples of sequential sampling tasks in the laboratory would be the random dot motion task, the beads task, or the box task. Examples of real life sequential sampling problems would be deciding where to go on holiday, or whether to propose marriage. People with ADHD adjust speed, and consequently the amount of data gathered, less than controls in response to task demands. Impaired speed accuracy trade-off is associated with greater risk of being a perpetrator or victim of violence

4) Motor impulsivity corresponds to failure of inhibition, as measured by the stop signal task or the Stroop task. Real life examples would be inability to stop oneself from making inappropriate remarks. This is factor 1 of Caswell et al.'s analysis. Motor impulsivity does occur in ADHD. Chamberlain et al. found reduced motor inhibition, as measured by the stop signal task, in both OCD and trichotillomania (compulsive hair pulling). The conditions differ in that OCD sufferers also show less cognitive flexibility.

5) Caswell et al. describe reflection impulsivity as involving a general preference for speed. The task they use to measure it does have speed and an accuracy version, but their analysis seems to be not sensitive to speed accuracy trade-offs. Reflection impulsivity seems to correspond to the jumping to conclusions bias in the beads task shown by schizophrenia patients, not an impaired speed accuracy trade-off. However, the link between reflection impulsivity and jumping to conclusions is not confirmed by empirical data, and therefore students are not expected to go into detail.

6) Caswell et al.'s third factor is measured by the immediate memory task, which seems to measure sustained attention. However, Caswell et al. do not explain, and therefore students are again not expected to go into detail.

Dalley et al. found that drug taking in humans is associated with a questionnaire-based measure of impulsivity, and with one aspect of sensation seeking. Rats bred for impulsivity consume more cocaine than rats bred to be less impulsive, and worked harder for nicotine and sugar.

There is some evidence that different kinds of impulsivity are selectively associated with different real world problems. It is less clear, from the material in the pensum, how impulsivity is associated with mental health conditions. Wiecki et al. mention some kind of impulsivity being associated with ADHD, OCD, Tourette's syndrome, substance abuse, gambling, and eating disorders. It is less clear how specific those associations are, because patients with a particular condition may not have been tested for all kinds of impulsivity. ADHD is associated with all four kinds of impulsivity mentioned by Wiecki et al. Gambling, OCD and trichotillomania are mentioned in connection with only one kind of impulsivity each, but either patients were only tested for one kind, or it is not clear whether there were other tests.

**Question 2:** Hva er vanelæring eller "actor-critic" læring, og hva er dens kliniske betydning?

What is habit or actor-critic learning, and what is its clinical significance?

**Sensorveiledning**: Many of the decisions people make during a day are not deliberate, they are habits, carried out on autopilot, without consideration of the consequences. The association is between stimulus and response. For that association to be useful, it needs *some* connection with an outcome. And so if a response results in an outcome better than the current baseline, the association between the preceding stimuli and the response is strengthened. However, no record is kept of the outcome. Consequently, if the outcome changes its value, for example chocolate may not be so attractive immediately after eating half a kilo of it, a habit or stimulus-response association will still favour the response that obtained chocolate. Likewise, if someone has developed a health condition that makes a change in diet necessary, eating habits can interfere with a diet based on new evaluations of different foods.

The advantage of habits is that they automatise behaviour that initially needed attention, their drawback is that they are slow to adapt to changing circumstances.

Habits become clinically relevant when they are counterproductive. Then their slow adjustment, their resistance to deliberate control, and their insensitivity to a devaluation of the outcome by thinking differently about the outcome make it difficult to improve a patient's life. There are several different ways in which habits can create problems.

When changes in behavior are needed, for example to deal with a health problem, habits may interfere with the adjustment. And because habitual responses respond relatively little to devaluation of the outcome, it may be necessary to replace a bad habit, with a competing, better habit. That does not remove the old habit, and if the new habit were to be extinguished, the old habit can return. This resurgence is an analogue of renewal in Pavlovian or Stimulus-Outcome conditioning.

Habits also play a role in compulsive drug seeking. First, through extended training, control over a response gradually transfers from the outcome to the stimulus.

Second, two processes of Pavlovian to Instrumental Transfer (PIT) can make the stimulus more effective. Specific Pavlovian to Instrumental Transfer occurs when the contingency between stimulus and outcome provides a reminder of the response that produced the outcome, and the response is strengthened by that association. In this case, the transfer is specific to the outcome. General Pavlovian to Instrumental Transfer is driven by the affective state produced by the outcome, which would would provide a reminder of all responses which produce that feeling, and strengthens them all. Everitt and Robbins argue that this produces drug cravings, though they do not explain the link. A possible link is that strengthening a response means not only that the response becomes more likely, but also that one wants to perform the response.

Third, only about 20% of humans and of rats compulsively seek drugs. Pelloux et al. provided either moderate or extended training to obtain either sucrose or cocaine. In the extended cocaine group, they found a few rats who just tried harder when responses for cocaine were punished.

It is difficult to find out to what extent this compulsive drug seeking is a cause or a consequence. Noncontingent alcohol delivery did interfere with reducing responses to obtain chocolate when that chocolate had been devalued by letting people eat lots of it. Stress leads to greater control by habit. To find out whether differences between those who use drugs and those who don't are a consequence of drug taking or of a pre-existing risk factor, it helps to look at endophenotypes. To the extent that a risk factor exists that is either genetic or caused by shared familial environment, close family members should share the traits of drug users, though possibly to a lesser degree. Close relatives of drug users share longer reaction times in the Stop signal Reaction Time Task, and both their overall score and their scores on subscales of the Barrett Impulsivity Scale are in between those of controls and their drug using relatives. Some kinds of impulsivity are risk factors.

**Question 3**: Hva er rollen til prediksjonsfeil i kognisjon?

What is the role of prediction error in cognition?

Prediction error is the difference between the expected outcome and the experienced outcome. One fundamental role of prediction error is to drive learning. The more experience deviates from prediction, the more there is to learn, and the larger is the learning rate. That is the reason why Craske et al propose maximising prediction error in extinction training. Their main theoretical concern is that habituation, which reduces the effect of the US, reduces prediction error and therefore reduces the learning rate. They therefore advocate avoiding habituation by not gradually increasing the intensity of exposure, but instead randomly mixing the order. They also assume that the effects of extinction training will be context specific, and the way to work around that is to extinguish in a wide variety of contexts.

Prediction error is also relevant to solving a different problem in Pavlovian or classical onditioning, namely working out whether current experience results from an already known cause-effect relationship, or whether a new, unknown cause-effect relationship operates. Gershman refers to this as state discovery: is the world still in the same state, meaning familiar cause effect relationships, or in a new state, meaning new cause effect relationships? It appears that evolution has given us a rule of thumb that if the world is as we know it, prediction errors should be relatively small, reflecting incomplete learning, random variation, or a gradual change. The appropriate response is to adjust the strengths of existing associations. If instead prediction errors are large, it is likely that some unknown factor is at work, and new learning is needed. Then it makes sense to create new associations. That reasoning is behind Gershman et al.'s recommendation that the creation of context-specific inhibitory associations in extinction can be avoided by changing prediction error gradually, instead of introducing a sudden, large change.

A third role that prediction error plays, in instrumental learning, is to help distinguish the effects of one's own actions from the effects of other causes. A possible solution is to predict the outcomes of one's own actions and to attribute any large enough deviation to external causes. For the purpose of solving this attribution problem, "large enough" must be defined in statistical terms: How unlikely is the observed event given how precise prediction and the observatyion of the result are believed to be? If causal attribution depends on this subjective estimate of precision, then miscalibration (i.e., a mismatch between perceived and actual precision) should result in erroneous attributions.

For example, say I practice archery. I expect my arrows to be normally distributed around the bull's eye, with a standard deviation of 10 cm. If I find a standard deviation of 40 cm, I keep being surprised by where my arrows go. I could recalibrate my estimate of my ability, assuming that I am having a bad day, or that I am just not as good as I thought. Or if I am, for some reason, unable to recalibrate, I can explain away my poor performance, perhaps choosing to believe that someone spiked my drink. An unspoken assumption of Frith's proposal is that schizophrenia interferes with recalibration.

Frith (2005) proposed that believing one's predictions and/or perception to be more precise than they really are contributes to hallucinations. If I keep dropping things and fumbling about, yet I remain convinced that I can precisely predict my movements, I may conclude that my movements are not under my control. The same principle applies to predicting sensations. Most people can't tickle themselves. If the sensations predicted based on the planned movements are close enough to the actual sensations, they attract little attention. However, there is always random variation in the predictions that are generated, and random variation in the movements carried out. If I underestimate that randomness, if I believe I can predict the sensations resulting from my movements very precisely, then the unappreciated randomness means that my experience is unlikely to be close enough to prediction to be ignored. It will feel vivid, because the less sensations match prediction, the more attention they get. Sensations that are well predicted, are suppressed. And patients with schizophrenia do find the sensations produced by their own actions equally as ticklish as the sensations caused by other people.

Also, see role of prediction error in reconsolidation.

## Short questions (Choose one of two, each answer counts as 20% of the final grade)

**Question 1**: Forklar hva som skal skje, i henhold til driftdiffusjonsmodellen, til fordelingen av responstider for riktige og feil beslutninger i en oppgave som "dot motion" når du gjør hvert av følgende:

1) Flytt avgjørelsesgrensene nærmere eller lenger fra hverandre.

2) Endre forutintatthet (bias).

3) Endre drivhastighet (drift rate).

4) Endre ikke-beslutningstid non-decision time.

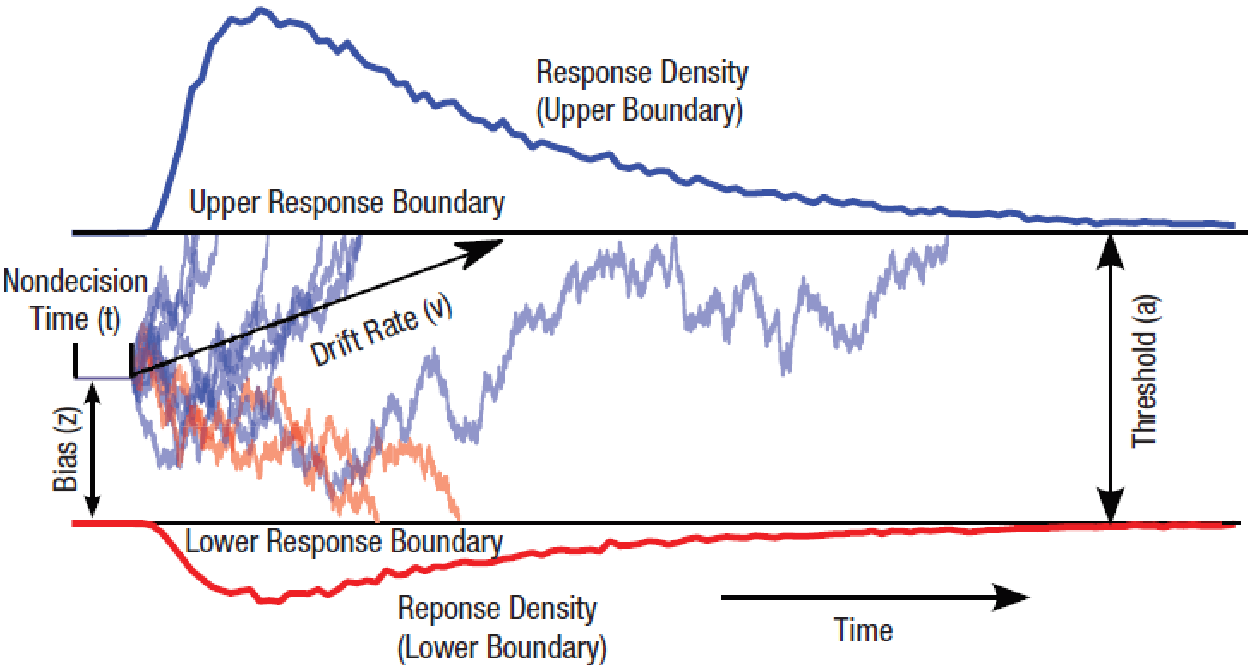
Hvilke av disse parametrene har adferdskorrelater som er klinisk interessante?

Explain what should happen, according to the drift-diffusion model, to the distributions of response times for correct and wrong decisions in a task such as dot motion when you do each of the following:

1) Move the decision boundaries closer together or further apart.
2) Change bias.
3) Change drift rate.
4) Change nondecision time.

Which of these parameters have behavioural correlates that are clinically interesting?

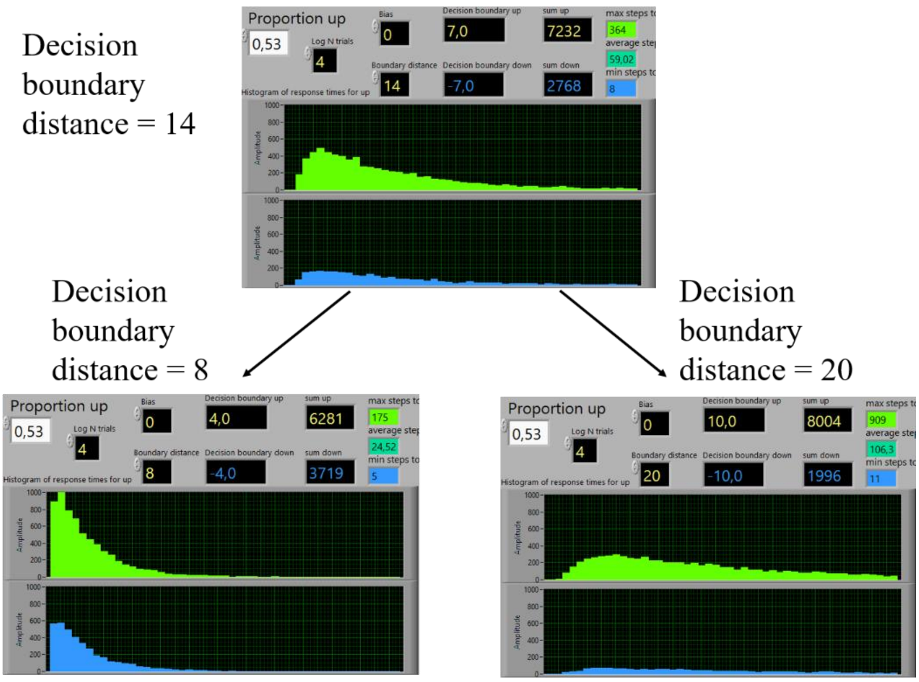
**Sensorveiledning**: The underlying decision model is summarised in the figure:




There is a decision variable, which can be thought of as each piece of evidence getting a vote that favours one of the two alternative interpretations of the evidence, or two candidates for election. The votes come in random order, and the election ends the moment one of the candidates has

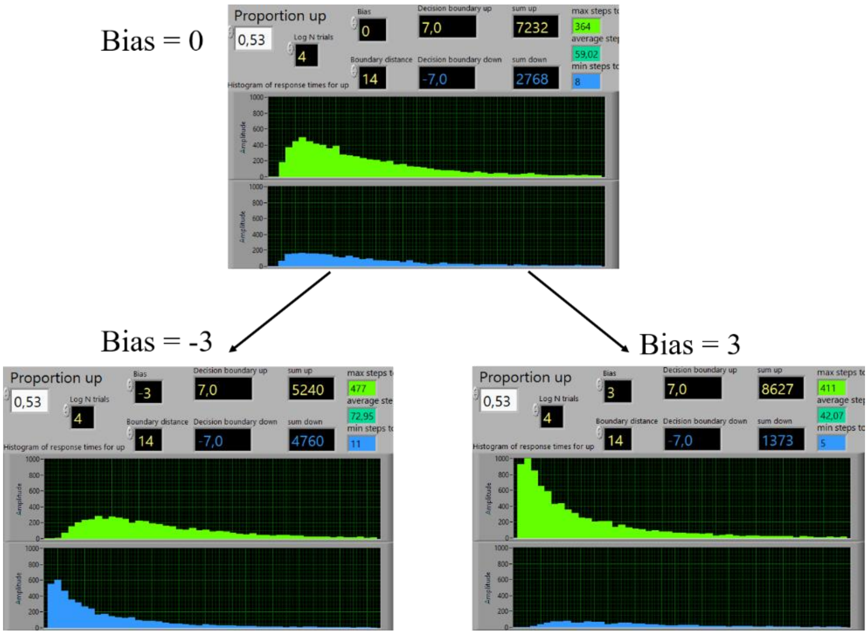
N votes more than the other. Each track in the figure represents the progress of one election, more specifically the *difference* in votes. The midpoint between the decision boundaries represents both candidates having an equal number of votes. The response densities show the results of many elections with the same voters casting their votes in random order.

The distance between the midpoint and each of the decision boundaries represents how large a majority one alternative needs to be chosen. (The distance from the midpoint to a decision boundaries is N, but students don't need to be that specific.) The larger the majority that one alternative needs, the further apart are the decision boundaries. If N = 50, then the earliest possible decision can come after 50 votes. If N = 10, the earliest decision comes after 10 votes. Also, the smaller N is, the easier it is for random fluctuations to create a majority. In the extreme case, if N = 1, the first vote leads to a decision, and the election stops. Therefore the closer the decision boundaries, the faster but less accurate the decisions, because it is easier for random fluctuations in the order of votes to give election victory to the less favoured candidate. The response density curves would be squished together to the left, and the total number of elections won by each candidate would be more evenly distributed, like here:




The clinically relevant application of that idea is that one form of impulsivity is problems with appropriately trading off speed against accuracy. If speed matters, faster, but less accurate decisions can be made by moving decisions boundaries closer together. If accuracy matters, move decision boundaries further apart. If someone keeps decision boundaries closer together than normal, they make faster, but less accurate decisions, which is one way of being impulsive.

Bias then corresponds to giving one candidate some extra votes to start with. That is sensible if one outcome is more common or associated with a greater payoff. The response density curve for the favoured alternative will be squished together to the left, and will have more area under the curve, representing a larger number of elections won. The response density curve for the less favoured alternative will be pulled apart to the right, and will have less area under the curve, representing a smaller number of elections won.




A change in drift rate corresponds to the votes coming in at a different rate. If votes come in faster, then both response density curves will be squished together to the left. The pensum contains no example of this. Attentional processes may increase drift rate.

A change in non-decision time moves both response density curves in the same direction without changing their shapes. Non-decision time comes from everything that takes time other than the decision process itself, such as the time it takes information to get into the brain, and then out again to the muscles. The pensum suggests no relevance to a clinical psychologist.

**Question 2**: Explain Powers et al.'s experimental procedure for inducing hallucinations through Pavlovian conditioning. What are their most important findings? (In this short question, you can ignore the co)

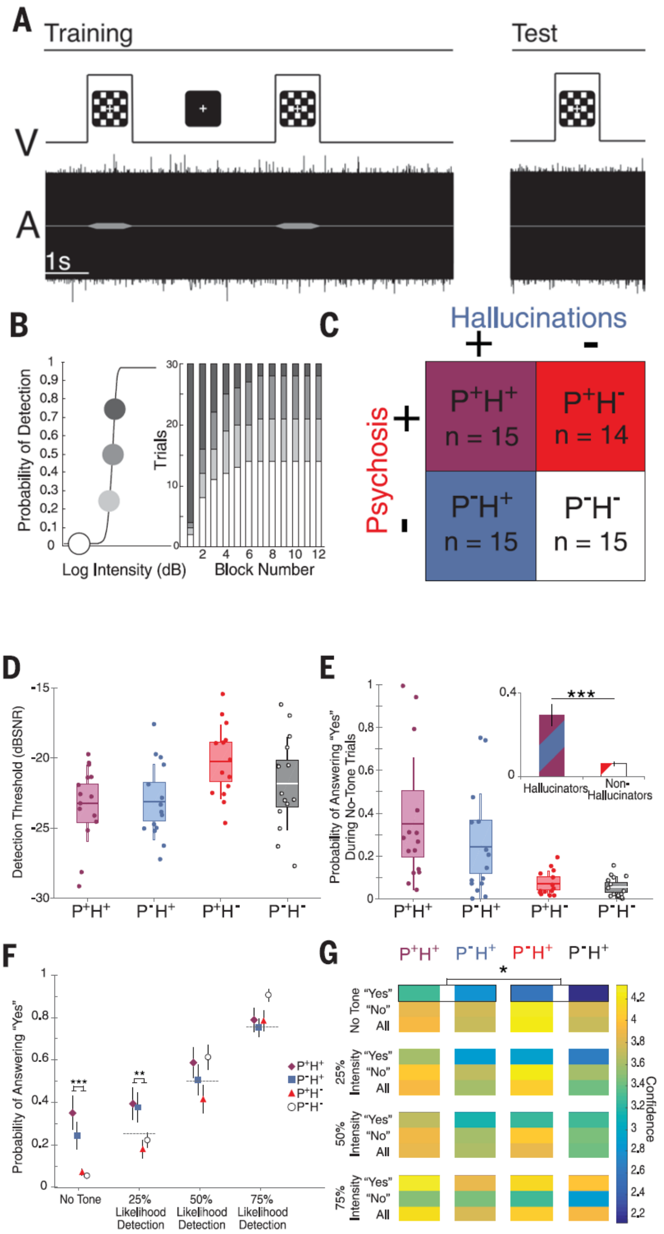
Forklar Powers et al. sin eksperimentelle prosedyre for å indusere hallusinasjoner gjennom pavlovsk kondisjonering. Hva er deres viktigste funn? (I dette korte spørsmålet kan du ignorere beregningsmodellen.)

mputational model.)

**Sensorveiledning**: The procedure is summarised in Powers et al.'s figure 1. A visual stimulus is paired with a tone at four different sound levels, partially masked by noise (A). The sound levels are individually calibrated to be audible 75%, 50%, 25% and 0% of the time (B). In the first block of training, the loudest sound is most common. In later blocks, the quietest sound becomes most common.

Participants are divided into four groups according to the presence or absence of psychosis and the presence or absence of hallucinations.

The results indicate that only the presence of hallucinations is associated with a higher probability of hearing a sound when there is none, and that people with hallucinations are more confident of hearing a sound when there is none.



**Karakterbeskrivelse:**

| Betegnelse | Generell kvalitativ beskrivelse av vurderingskriterier | Fagspesifikk beskrivelse med relevans for vurdering av besvarelser/arbeider med bestått/ikke bestått |
|---|---|---|
| **Bestått** | Kunnskapsmengde (teoretisk/empirisk)<br><br>Innsikt (oversikt/forståelse)<br><br>Fremstilling (struktur/begrepsapparat)<br><br>Bruk (selvstendighet/originalitet) | Besvarelsen/arbeidet reflekterer tilstrekkelig relevant kunnskapsmengde og oversikt/forståelse av fagområdet.<br><br>Besvarelsen/arbeidet er strukturert og har et noenlunde konsist begrepsapparat.<br><br>Besvarelsen/arbeidet dokumenterer en viss grad av selvstendighet og evne til å trekke egne konklusjoner. |
| **Ikke bestått** | Mangler vesentlige kunnskaper.<br><br>Utilfredsstillende fremstilling med klare feil og mangler | Besvarelsen/arbeidet reflekterer dårlig generell kunnskap og/eller faller på siden av oppgaven. Fremstillingen er ustrukturert, mangler oversikt over fagområdet og inneholder mange direkte feil. |

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