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Analyzing the stress produced in Computer Science students during exams and the effects of gender stereotypes

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Preface

I hope this research will make people understand the importance of mental well-being and how it affects students' daily lives. Students like me who suffer from social anxiety and hypertension face many hurdles which usually remain unspoken. Many small and unnoticeable factors can be significant for students suffering from mental health issues. With this thesis, I hope to draw the attention of students, parents and teachers to consider the importance of mental health.

During my thesis, I learned a lot about students and their experiences. I understood how students feel during their course and their daily challenges. I gained perspectives about the bias present in the areas of Computer Science and the difficulties that some female students face. I hope my study contributes to improving the educational experience of students. Most importantly, I hope the students who read my thesis will understand that we all go through the same hurdles during our academic life. Even though the challenges are different for every student, in the end, we're all in the same boat.

My research was supported by many teachers, supervisors, and students. I would like to thank Professor Felienne Hermans for accepting my proposal and candidature to write a thesis under her supervision. The openness and liberty you granted me made me explore this study area of study and work on it. Secondly, I am eternally grateful to Anna for being my supervisor and mentor throughout the process. Anna, the efforts and input you have put into this thesis are more than I could ask for. Apart from the critical analysis and feedback you provided, your kind and understanding nature always made me feel comfortable and excited to work with you. I want to thank Shirley for being my supervisor. Although we couldn't work for a long time, sharing ideas and learning from you was excellent. And Fenia, thank you for all your efforts and help.

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Abstract

Exam stress has been a challenge in the life of many students. The race to achieve a good grade is more difficult with the increase in education standards and self-requirements. Although exam stress is persistent in all areas of education, we focus on understanding its effects in the field of Computer Science. Some factors that affect exam stress include differences in education systems, background knowledge, and gender stereotypes. These factors have been playing a crucial role in creating or increasing exam stress and affecting students' performance during exams.

In this study, we aim to understand at what levels Computer Science students experience exam stress, the role of gender stereotypes, and their effects on Computer Science students during exams. We conducted our research using surveys and interviews to collect responses from students about their experiences and perspectives on exam stress and the role of gender. 26 students participated in the survey, with 12 females and 14 males. Similarly, 5 participants were interviewed, including 2 females and 3 males. The results indicate that students experience exam stress, and females tend to be more stressed about an exam than males. We also encountered some ambivalence in the results where on the one hand, there was no explicit gender bias. In contrast, on the other hand, there was a sense of stereotypic stress that was present. Lastly, we also learned some possible remedies to overcome exam stress and anxiety.

1 Introduction

With the increasing level of education standards and competition across industries, the level of stress and pressure undertaken by students is increasing at a gradual rate. The commitment to get substantial grades and scores has affected the minds of these young opportunists. The stress and anxiety faced by students affect many areas in the education cycle. Some of these include exams, cognitive thinking, decision making, and self-efficacy [35][9][49]. A considerable amount of stress and anxiety is difficult for many students and their mental health. The way this stress affects their performance in the exam, overall behaviour, and growth is a topic of sensitivity [39]. The stress students encounter during exam days is persistent in all education platforms and fields. Still, the level of pressure and stress is notably high in students undergoing Computer Science education [34]. There are many reasons for exam stress, which are diverse and subjective amongst students [15][33].

Exam stress factors depend on many personal and interpersonal reasons, background knowledge and schooling, concept-driven reasons, stereotypes regarding Computer Science studies such as gender dominance, and cultural reasons [28]. Similarly, personal requirements, self-standards and family expectations can also be pivotal when focusing on the stress produced during the exam period [28]. Many students face a considerably high amount of stress during exams, making them perform worse than they can in a stress-free situation. Furthermore, the prevalence of stereotypes in Computer Science has been an issue for decades. The low representation of female candidates in the field of Computer Science education and work areas is an outcome of these societal stereotypes and mindsets [7][52]. The low participation of females in Computer Science is dependent on many factors, including the absence of female role models, the difference in perspectives, and stereotypic threats [7][52]. Stereotypic threats play a significant role in dissuading females from undertaking a career in Computer Science [42][43]. These stereotypic threats make females feel unwelcomed and belong to a minority in the areas of Computer Science. Furthermore, the difference in job opportunities, male-dominated decision-making, lower salaries, and low female enrollment in universities are some of the outcomes of these stereotypic threats for females in Computer Science [1]. The basis of this study is to investigate these factors and stereotypes' effect on students' exam performance and how exam stress affects their overall exam experience.

The main aim of this study is to understand the level of exam stress and anxiety produced in Computer Science students, the effects of gender stereotypes, and other factors that generate exam stress. We strive to understand why students underperform than expected. Furthermore, our prime motive is to investigate the role of stereotypes in Computer Science and their effects on females' exam performance. We plan to find relevant results and reasonings for our study with the help of surveys and interviews and analyze our study based on the responses we get from the participations. We focus on drawing connections on how the two data sources interlink with the stress levels during exams and stereotypes. Lastly, we focus on combining all the information in a representable fashion to be understood and deduced even by naive readers.

2 Theoretical Framework

2.1 Gender Issues

The consideration of gender has been playing a vital role in the field of Computer Science for decades, and it is still persistent on a large scale. Gender issues in Computer Science education have been a problem for many years. Moreover, the rate of female participation in Computer Science education has been declining substantially over the years, leading to a low representation of women pursuing Computer Science. In the United States, the number of female representations in Computer Science saw a rise in the mid-1980, but it has been declining ever since. The number of degrees awarded to women in 1984 was around 37% [25], which went down to approximately 26% in 1998 [23].

Similarly, master's degrees rose to around 33% in 2000 but declined to 27% in 2008 [24]. Currently, only 18% of the women constitute the number of graduates with Computer Science degrees [54]. The situation is similar in other regions as well. In a research based on the participation of females at bachelor levels in some European countries and the UK, it was observed that approximately 80% of the enrolling or graduating students in the area of informatics were male students [31][32] and in some parts representation of women is slightly higher but not greater than 30% for students pursuing their bachelors [55]. The number of women seeking higher studies is also very low for Masters and PhD students. The enrolment is only around 20% - 25%. The overall percentage of female master's graduates is about 20% - 30% for most European countries and the UK, with some exceptions of approximately 35% in some western European countries. Lastly, for PhD students, all countries have a range of lower than 25% of women completing their graduation in Computer Science PHD programs [30]. Surprisingly, according to the National Science Foundation 2016, architecture or biomedical engineering fields are female-dominated [58]. Furthermore, this is not the case in Computer Science, even though women earn almost half of the university degrees in the fields of psychology, sociology, or STEM (Science, Technology, Engineering, and Math) [58]. As a result of this underrepresentation of women in computer science education, there is also a low number of females in the IT sector[11].

There are many reasons for the underrepresentation of women in Computer Science. These reasons vary and include the lack of female role models, girls attending fewer co-education schools, social factors and stereotypes [7][52]. Girls tend to get less support from their mentors, parents, teachers and peers in relation to boys [47][16][60]. Moreover, girls who portray abilities compatible with boys in STEM fields are still prone to less support [57]. A mechanism found to have a role here is the tendency of parents and teachers to have more inclined beliefs toward math and science as a more masculine field [22].

Consequently, expectations of girls in these areas are lower [56]. Additionally, there is a considerable amount of stereotype threat which is prominent in the field of Computer Science for women. This stereotype threat is experienced when women know that in a group of people, they are the minority [4]. This stereotype threat can reduce the level of belongingness that women feel in STEM and Computer Science studies. Additionally, it can reduce their interests in the field of Computer Science and negatively affect the female students' expectations of success [41]. The inclusion of these male stereotypes in the environment, along with social regulations for women, negatively impacts the self-efficacy (strength of someone's belief in their ability to master or complete a task in a specified domain or context) of women [6][63]. Along with this, the work and educational environment can play a significant role in demotivating women to

pursue careers in Computer Science courses as the women in STEM fields typically have lower and inferior status, lesser salaries compared to men and the chances of getting a promotion is fewer in comparison to their male counterparts which is discouraging for women in pursuing Computer Science [42][43]. Other reasons that contribute to women's low participation in Computer Science include some barriers to advancement such as limited resources, policies and practices that give advantages to men in classrooms, and program inconvenience such as timings and difficulty level of courses [1][10].

The imbalance of genders in computer science when women are underrepresented can have many consequences. These consequences exist in a self-sustaining mechanism where the underrepresentation of women in Computer Science contributes to the factors mentioned earlier. A study [17] on exploring gender imbalance in computer science hypothesized that the unwelcoming and discouraging nature of the field of Computer Science could increase the lack of respect towards women in Computer Science. It will also result in fewer female opportunities in Computer Science careers and increased sexism. Moreover, the threat of inequality in computer science for women can directly result in a reduction in the number of women enrolling in Computer Science programs [17]. Furthermore, other consequences of the gender imbalance can contribute to detrimental effects on learning opportunities, economic participation, health-care and political empowerment affecting the society as a whole [44]. Moreover, the gender imbalance of teams in a masculine-dominated working culture can lead to technical decision-making based on masculine judgement and experiences, leading to a more male-inclined bias toward the results and judgement [67]. Supporting this claim, one other review on the diversity of gender in teams throws light on the fact that a collection of gender-diverse groups has increased creativity and productivity with a higher competence to stay in line with their goals which is difficult when the teams are more inclined towards one gender [66]. Moreover, apart from the impacts on the decision-making and analytical skills, the gender differences and the low presence of women in pursuing Computer Science education are affecting students psychologically, and are leading to issues with self-confidence, career decisions, learning, attitude, engagement, society structure, and the experience of exam stress during studies [70].

2.2 Exam Stress

Stress is the response produced by our body to the pressures that are created by a situation or event, also called the 'stressor'. What acts as a stressor for any person can vary according to social, economic, or psychological circumstances [51]. Exam stress amongst students has been a topic of interest for a very long time, and the persistence of exam stress is experienced by many students [34]. Generally, it is a feeling of worry or being under a high amount of pressure. If this exam pressure is undertaken negatively by the student or grows to an excessive amount, it can lead to a feeling of anxiety. These feelings are common amongst most students and can be difficult to tackle [34]. Moreover, exam stress fluctuates in nature. It can be prevalent in the initial part of the study program for some students or throughout the program in some cases [15][33]. There are many reasons why students undergo exam stress, ranging from less preparation and peer pressure to unhealthy study habits [20]. The ChildLine National Exam Stress Survey gave insights that amongst 1300 participants from the survey, almost 96% had a feeling of anxiety about exams. Moreover, nearly 60% felt pressure from their parents, and around 64% claimed to have received no support when tackling exams [61]. Furthermore, the stress produced during exams can produce many symptoms, emotions, or consequences.

A wide range of factors play a significant role in the stress produced during exams, including external and internal factors. External pressure, as the name suggests, is triggered by the external stimulus rather than the person [28]. Many factors constitute external pressure, the engagement in extracurricular academic activities, work and financial situations, or social issues such as peers or family expectations. Often students need to match the criteria or expectations of their parents, teachers, siblings, or any other individual or class of individuals, leading to the birthing of external pressure [28]. The tendency to "not let anyone down" takes place and simultaneously increases exam stress [53]. Internal pressure, on the other hand, as the name suggests, is created mainly by the student [28]. This internal pressure can be generated due to the competence and aptitude skills of a student or learning facilities. Sometimes, even the desire to achieve a good grade or be awarded the best of honours, a scholarship, or a job offer can create a substantial amount of internal pressure. Similarly, there are times when even getting a good grade is a necessity to fit into a group of students or talented individuals [28]. A few additional factors of a different nature can also have a role. First, mental health issues such as anxiety or depression can also be prime reasons that enhance internal pressure [45]. The second, is lack of preparation [50]. Often students cannot complete the entire curriculum due to controllable or uncontrollable reasons, which significantly adds a lot of stress during exams (29). This incomplete preparation can lead to a feeling of extreme nervousness and affect the performance on the exam day. Interestingly, it has also been noticed that exam stress positively can be fruitful for many students. Exam stress can be used in an optimistic way to help boost performance, increase the focus level, and create excitement, resulting in an overall improvement in performance, which is labelled as "eustress" [37]. This eustress can enhance decision-making skills and improve student performance during exams. Additionally, continuing the existence of gender stereotypes in Computer Science as explained above, it should also be noted that such stereotypes can add to higher experiences of stress, specifically for women.

A final important aspect of exam stress is that it can produce several other symptoms. The symptoms produced due to exam stress are varied in nature and intensity. Consequently, they can affect the students' overall performance during exams [35]. Some of the symptoms are physical, psychological, and cognitive effects [39]. The impact on cognitive functions can

hamper the performance of students during examinations. If the load on the cognitive system is high, it can reduce the level of attention and concentration during exams [9]. A study to examine stress during examinations and its effects on cognitive functions revealed that the loss of attention or affected decision-making due to the cognitive operations are affected by direct or indirect impact of the nervous system. In relation to our previous section about the effects of gender in Computer Science, a study revealed that the impact of exam stress could be more substantial for female students. Moreover, this increased amount of exam stress weakened their cognitive abilities and cardiovascular parameters such as blood pressure and reaction times before the examination.

2.3 Interventions and Achievements

Addressing the overall exam stress and the representation of women in the field of Computer Science at all levels, from undergraduate to postgraduate levels, has been challenging [29]. Many initiatives have been taken in the form of university projects, conferences, and networking opportunities to reduce the experience of stress and the gender gap in the field of Computer Science [29]. The main targets of the interventions to reduce the gender gap are to tackle the mechanisms that create a gender rift in Computer Science. Some of these mechanisms include gender differences at an early age, stereotypes in workplaces, and equality in job markets [29]. The initiatives also aim at increasing the rate of female participation in the field of computer science and women in the areas of computer science.

To improve the situation of gender equality at national and European levels, many selective measures have been taken in the STEM fields. To improve the condition of the labour market, the European Union's Strategy for Gender Equality in STEM has been set up [29]. The primary purpose of this is to provide gender equality in career fields, maintain gender equilibrium in the decision-making bodies, and incorporate gender in research and innovation [19]. Furthermore, there are also strategies defined by the European Union to motivate and empower women to play an active part in the digital age [29]. The European Union took the Women in Digital (WID) initiative to observe the participation of women in the digital economy [69]. On Digital Day 2019, 26 nations from the EU and Norway signed a statement to have an active and prime part in digital technology sectors. The declaration also entailed women having equality in technology areas and was signed by many major international and EU companies [69].

In addition, many universities have also taken initiatives to reduce the gender gaps in computer science. TU Dublin - Ireland, in 2012, started the CS4All School of Computing [38], aiming to increase the number of female participants in the Computer Science undergraduate programs. The school also aims to reduce the number of students who fail to progress in the critical first year to keep the interest of female participants persistent in continuing their education [38]. The school has seen some good progress over the years with the number of females enrolled. With a strong emphasis on subjects such as Internationalization and Globalization in the bachelor's Computer Science program, the participation rate of these newly introduced subjects in the standard Computer Science course is double the ordinary Computer Science course. Furthermore, the rate of retention of students has also been high. 89% of students have progressed from the critical year 1 to year 2, the highest retention rate for Computer Science in Ireland [38]. In 2005, the University of Bamberg in Germany started the Bamberg CS30 Strategy Faculty of Information Systems and Applied Computer Sciences [5]. This initiative aims to reach a female/male ratio of a minimum of 30% across all Computer Science programs [5]. The results of this initiative are optimistic as the enrolment rate of females in first-year Computer Science studies has seen a rise. Furthermore, since 2013 the rate of females enrolling in the first-year Computer Science studies has reached around 37% in 2017, a new record in Germany [5].

Apart from university programs and projects, some conferences are being conducted to draw females' attention to Computer Science. The Grace Hopper Celebration was established in 1994 in the United States to attract females' career and research interests in computing [21]. Similarly, IEE has launched the IEEE Women in Engineering International Leadership Conference (IEEE WIE ILC) [27]. This conference aims to aid professional females in the technology field and the opportunity to shape and produce communities. These communities are fabricated for innovation, knowledge sharing, and mutual support. Its prime objective is to

provide professional development for senior and mid-level women [27]. The well-planned and long-term programs can play a vital role in attracting more women to Computer Science and STEM fields in the near future. However, some initiatives have been proven fruitful in attracting more females to enrol on Computer Science studies. We still have limited information about the effectiveness of all the interventions in eliminating stereotypes in Computer Science [40].

Many initiatives have been developed to tackle exam stress and anxiety. Even though no initiatives are focusing on reducing the stress of Computer Science students during exams, some measures are formulated to reduce the experience of stress and anxiety during exams in general. Furthermore, some educational and psychological interventions have also been examined to reduce stress and anxiety during exams [26]. One study addresses stress and emotional behaviour as the prime component of exam stress. It focuses on test-taking and study skills to reduce exam stress [8]. Similarly, a few studies that focused on cognitive and physiological dimensions of exam stress successfully reduced the pressure students experienced during exams [13][64]. Furthermore, many self-help guides and treatments have been invented over the last decade to tackle depression and exam stress. One such instance is the internet-based cognitive behavioural therapy (I-CBT) concentrates on protocols that try to reduce exam anxiety symptoms. This method focuses on therapy based on reading and practising. After examination, the study is effective in lowering exam stress [48][71].

Lastly, several initiatives have been taken to reduce exam stress and gender stereotypes in Computer Science. However, it remains a pressing issue, both exam stress and gender in this specific context. Consequently, further research is required to understand how gender stereotypes affect students during exams and mechanisms that can be developed to reduce exam stress in Computer Science students. Continuing on this point, our research focuses on understanding how these factors and stereotypes affect Computer Science students during exams and the level of stress they experience.

3 Method

3.1 Research Design and Measurements

We designed our data collection using two methods due to the variety of data we planned to capture. First, the survey focuses on extracting the general experience of exam stress. The questions are designed across methods and concepts that could be calibrated without contextual information. Second, the interviews were conducted to get a holistic view from the participants and then recognize the possible factors and perspectives. By incorporating a 2-way data collection method, we found the similarities between the survey responses and interview answers without losing any information on the insights about why certain emotions get triggered during exams.

The structure and content of the survey are as follows. The survey contains questions about stress, anxiety, teaching methods, more stressful exam assessments, the importance of background knowledge, and retakes for a course. When creating the survey, we have considered many different aspects to gather a comprehensive idea about how and on what levels these factors affect the participants' emotions during exams. The survey required participants to enter their data such as age, gender, contact information, course type, and academic background. The survey consisted of 24 questions which were answered on a scale of 1 to 7, where 1 denoted a strong disagreement and 7 denoted a firm agreement. The time required to complete the survey was approximately 15 minutes.

The questions in the surveys are diversified, encompassing the topic of stress, gender bias, learning and assessing methods, etc. Each question is derived from a particular source or deduced from an article/ scientific paper and modelled in a way that fits our use.

Q1-2. (7) The initial three questions are based on the Perceived Stress Questionnaire (PSQ) [36], which was modelled as a tool to evaluate certain events in our daily lives that are stressful and trigger our health systems. The Perceived Stress Questionnaire (PSQ) is used as a reference for carving the questions to measure exam stress impacting a person's mental health.

Q3-4. For these questions, the test anxiety questionnaire developed by Nist and Diehl in 1990 was used [46]. This questionnaire is used to understand the extent to which a student undergoes exam anxiety, ranging from mild, low, or high. This questionnaire is used as a basis for comprehending the level to which human anxiety gets triggered during exams and the physical symptoms accompanied by it.

Q5-7. These questions are inspired by a paper published at the University of Isfahan titled "development and validation of a test anxiety inventory for online learning students" [3]. The paper introduces a unique questionnaire which engulfs questions about a student's performance under exam stress and the setbacks of exam stress. These questions are used as a basis for formulating Q7. which focuses on understanding which exam questions (objective or multiple-choice questions (MCQs)) are more stressful.

Q8. This question is inspired by a paper published at the University of Cambridge [2] to understand if oral exams are advantageous compared to written questions. This topic is intriguing for our questionnaire as, due to online education, many exams are conducted orally to reduce plagiarism or introduce spontaneity. Consequently, it can be considered essential to understanding the extent to which oral exams are stressful for students.

Q9-10. These questions are based on a paper published to measure the stress and behaviour

changes with remote learning and online exams [12]. Even though our research does not only focus on online exams as a form of assessment, the questions in this paper are also interesting, including topics like improved teaching methods and preparation methods.

Q11-12. These 2 questions have been inspired based on the assessment challenges teachers have faced based on a high school Computer Science questionnaire [14]. This questionnaire is used as a reference to formulate the questions in our survey on the importance of assignments/projects and their effects on the final exams.

Q12-16. The next set of questions has been created by taking an idea from the Computer Science attitude survey [65]. The questionnaire is a solid basis for gender differences and coding versus theoretical subjects. It helps us gain insights into the types of courses and their relation to exam stress.

Q17-Q21. These questions are inspired by Shirley de Wit's thesis on "Self-efficacy of Dutch primary school teachers towards programming education" [68]. The actual questionnaire served as a basis for understanding the importance of background knowledge in Computer Science and the essence of self-efficacy. Consequently, it can be considered beneficial to understand the perspectives of students.

Q22-24. Finally, some other questions on understanding stress during exams are based on personal experiences and observation. These questions can be considered valuable as they provide us with more information and background on the effects and factors of exam stress.

The second part of the data collection step was focused on interviews. We considered interviews an equally important step in gathering the information as it helps us get more in-depth insights from participants. The insights were crucial as they indicated personal experiences of the participants, feelings about gender stereotypes and their effects on the participants, real-life examples, and some observations that the participants made. The interview protocol was designed to gather the information with 5 main questions (7). The main questions had some sub-questions that revolved around the following topics: feelings during an exam, their experience with gender bias, and the causes of exam stress for the participants. We also focused on the course and program standards that create stress and possible remedies for the problem of exam stress.

3.2 Participants

The students that participated in the data collection were bachelor's and master's students currently pursuing Computer Science courses at Leiden University. Most of our participants had completed at least 1 semester at the university before participating in the surveys and interviews. Consequently, they had experience with the exams, teaching methods, and course requirements. To include a representative group of the field of Computer Science studies, we included participants from different programs in Computer Science, for example, Statistics, Artificial Intelligence, and Data Science. The participants in our survey belong to the age group of 21-27 years old, with an average of 24 years. The survey participants included 12 females and 14 males, whereas the interviews were conducted with 2 females and 3 males. Because of our interest in the factor of gender, we deliberately strived to include an as equal as possible male to female ratio.

	Number	Percentage	Range	Mean	SD
Female	12	46	-	-	-
Male	14	54	-	-	-
Age	-	-	21 - 27	24.34	2.51
Female	2	40	-	-	-
Male	3	60	-	-	-

Table 1: Demographic Information of participants (Survey vs. interview)

3.3 Procedure

The survey and interview questions were initially reviewed by the Ethics committee. Next, we advertised the research during lectures and on the university Discord server for Computer Science students to recruit participants for the survey and interviews. Subsequently, the survey participants followed the procedure and information about the survey mentioned on the advertising flyer. At the same time, the interview participants were chosen manually based on their area of study and gender.

3.3.1 Survey

The first step of the data collection phase includes the survey. The survey participants were initially required to provide their consent for the study, followed by information such as contact, age, gender, course type, and academic background. Next, the participants were allowed to answer the survey and provide their opinion on the individual questions.

3.3.2 Interviews

The next step of the data collection phase includes the interviews. We strived to choose an equal number of girls and boys. Similarly, to avoid bias, we randomly decided on the participants without any background knowledge of their previous knowledge, ethnicity, or age. The participants of the interviews were physically or virtually consulted at a fixed time and date. During the interviews, the participants were initially asked to sign the informed consent form and explained the audio and video recording procedure followed for later use of the interview answers. Next, the questions were asked chronologically, and the insights the interviewees provided were noted. In the end, interviewees were given space to ask questions or comments about the study or anything unclear during the interview.

3.4 Data Analysis

3.4.1 Survey

To process the survey data, several pre-processing steps were taken. The measures included data cleaning by removing missing values, removing blank entries, and reversing the input data for some dimensions. To process the survey data, we have used the Statistical Package for the Social Sciences, version 28.0.1.1 [59].

We created 10 dimensions taking together the 24 separate items. These dimensions were:
 1. Overall stress (based on items 1 – 5): this dimension includes questions about stress, anxiety, physical symptoms and students' performance during exams.

2. Exam type (based on items 6-8): this dimension contains questions based on the kind of exam assessments, including oral exams, reasoning and online exams.
3. Background knowledge (based on items 9-12): This dimension focuses on sufficient background knowledge, assignment performances and teaching methods.
4. Course type and requirements (based on items 13 and 14): this dimension includes questions about the nature of the course, whether theoretical or coding courses.
5. Knowledge gained (based on items 16,18 and 20): the questions in this dimension focus on the kind of information learnt through the course and the effectiveness of exam strategies.
6. Understanding and conveying (based on items 17 and 24): this dimension includes questions related to understanding and conveying the gained knowledge without the pressure of an exam or a passing criterion.
7. Retakes (based on items 22 and 23): the questions in this dimension aim to understand the experience of stress in the first and retake attempts of an exam.
8. Educational satisfaction (based on item 15): this dimension contains only a single question used to understand how satisfied the participants are with the way they make an exam.
9. Persistence of stress (based on item 21): this dimension also includes a single question to understand if exam stress is prevalent only in the initial part of the study program or throughout the program.
10. Expertise (based on item 19): the last dimension contains one question to get an idea if the participants feel they should constantly learn to stay an expert in their field.

We used the dimensions to measure the stress prevalent in the students and the factors that play a role by obtaining descriptive statistics on each dimension: range, average score, and variance. Next, we measured the correlations between the dimensions and the inter-item correlations with each dimension. Furthermore, to validate the reliability of a dimension, we performed the reliability test using Cronbach's Alpha. In the next section, we have focused on generating the frequency layout of each dimension to comprehend the level to which certain factors play a role in developing exam stress. Finally, as gender plays a crucial role in our research, we have compared the differences in overall exam stress between female and male participants using the independent sample T-test.

3.4.2 Interviews

To analyze the interview data initially performed the pre-processing step to make the data usable. The audio recordings were transcribed verbatim. Next, the transcripts were cleaned by removing redundant words and fillers. To process the data, we first coded the data into an excel sheet. We manually scraped each interview and segregated them based on themes. We then labelled the excerpts and categorized them as belonging to specific concepts. The labels included exam stress and anxiety, stress before an exam, gender bias, difference in education systems, stress due to course requirements, the difficulty level of a course, and remedy for exam stress. We manually read the data to gather the insights and acquire conclusive information from the interview data to find similarities. The similarities found were between participants of both genders and how they correlate to the excerpts. Furthermore, we focused on their perspectives and their ideology about exam stress. Through this step, we gained insights into the factors and reasons for the prevalence or absence of exam stress.

Overall, we combined our findings from the two analyses into a conclusive idea about the experience of exam stress in students, gender stereotypes, and factors that promote exam

stress. We have combined the two results per dimension and suggested some mechanisms that can mitigate the issue.

4 Results

4.1 Overall stress

For the first dimension, we considered the first five questions of the survey. This dimension includes questions related to stress, anxiety, physical symptoms, and other related topics. To analyze the first dimension, we created a variable "Overall_stress" and obtained a mean value of 5.01, and the variance was 2.80 . The range for this dimension was from 4.07 to 5.57 ; lastly, the Cronbach's alpha value was at 0.89.

Secondly, we will explain the interview data findings on the stress experience during exams. Upon analyzing the interviews with the participants, we found that almost all participants agree that they feel anxious or stressed before an exam. The most critical factors contributing to exam stress include lack of preparation, familiarity with the study program, or an anxious personality. Moreover, this stress is persistent throughout the study program for some students. In contrast, it is only persistent for some students at the start of the education program. The level of stress varies per individual where sometimes the level of stress is less while for others it is considerably high. This high-stress level depends on a few factors, such as which part of the program they are currently doing, the difficulty level of a course, and personal expectations. Overall, according to the survey results and the interviews, most students experience stress before or during exams.

Gender can also be an instigating factor for exam stress. Looking at the survey data, we performed the independent sample T-test on the first dimension to find out which gender feels more stressed during an exam. There was a significant difference between the scores of females ($M = 28.5$, $SD = 6.00$) and males ($M = 22.38$, $SD = 6.93$); $t(23) = 2.34$, $p = 0.028$. These results suggest that females experienced more exam stress in comparison to males. Specifically, our results indicate that the effects of gender affect the performance of females during an exam in the field of Computer Science. Similarly, according to the interviews, 4 out of 5 participants feel gender has some role in exam stress. One of the female participants felt that there is some stereotype present in the older generations even though the STEM fields have a high number of female students. The participant explained that her older generations feel that she is brilliant for doing CS studies. This makes her feel positive about herself but adds some pressure. Another female participant felt a different atmosphere in the courses where the male-to-female class ratio was skewed. The participant explained that she felt strange when she was the only girl in the class. Still, the male students in the class did not make her think discomfort, so it did not affect her overall. Additionally, the participant shared a story about her acquaintance in another university where the girls in a project group were made to do the reporting work, whereas the boys did the coding. Looking at the opinion of male participants on this matter, one male participant observed that girls generally are more stressed about an exam. The participant claimed this was a general picture of students before an exam. He had a feeling that amongst the people he had seen and interacted with, he felt that girls tend to be more stressed and anxious before an exam. Lastly, one of the participants did not have any real-life experience with this but felt that there is bias everywhere.

4.2 Exam type

For this dimension, we used questions based on the type of exam assessments, such as oral exams, reasoning and online exams. After analyzing the survey results, we obtained a mean

of 4.30 and a variance of 3.20. The range of this dimension was from 3.57 to 5.11, and the Cronbach's alpha value was 0.66. After assessing the info from the matching interview questions, we found that 4 out of 5 interviewees were neutral to the kind of exams and whether they were multiple-choice or descriptive questions. They experienced a feeling of stress in both situations. This was due to the difficulty level of the courses, course workload and the limited time to prepare for an exam. One participant added that subjects such as math and calculus are more stressful as the questions are not straightforward from the study material. These subjects exert more pressure during exams as they are unpredictable, and the questions asked in the exams are not the same as what was covered during the course. The participant in the interview said, "The more mathematical the course is so, the more exercises you need to do. No matter how well you do, despite the amount of study that you put into it. Because you tend to study a lot but then you never have the certainty that that will go well."

4.3 Background knowledge

In this dimension, we used questions 9-12 to understand the importance of background knowledge and teaching methods concerning exam stress. After analyzing the results of this dimension, we achieved a mean value of 5.40 and a variance of 2.30. The range lay between 4.96 and 6.15. This indicates that between a score of 4.96 to 6.15 on average, the participants score 5.4 on the importance of background knowledge concerning exam stress. Lastly, Cronbach's alpha value was 0.72.

After gathering insights from the interview, we found that 3 out of 5 participants felt that the differences in background knowledge and prior knowledge generate stress during exams. The level of knowledge acquired in the past education methods can determine the amount of effect it produces when it comes to exam pressure. This is due to the difference in education systems and the method of learning, which can be different. The reason why this generates stress is that the exams in the university are not significantly compromised. Especially students from different backgrounds (for example, engineering) must learn a new way of doing things. This is mainly because technology-related areas have another learning method and the practice of working is different. In contrast, the Computer Science course at Leiden University is more enveloping. It involves a lot of conceptual and technical fields of work. This can sometimes be challenging as it requires relearning things in a new way. One of the interviewees described this: "Yes, I think the difference in education system does create an amount of stress. Because in my Bachelor's, I was in an engineering school, and it was more technology-related. So there was a different way of doing things."

On the other hand, the remaining 2 out of 5 participants in our interviews felt that the difference in background knowledge does not play a significant role for them. The reason for this is that the participants think that as long as they feel that the concepts are still the same, they do not feel stressed with the new learning style and exams. The method of application of the knowledge might be different. Still, as long as they are aware of the rules, it does not instill a feeling of exam stress or pressure. Moreover, the students advocated that as long as the base knowledge is the same, even though the education system is different, it does not create a hindrance for them during exams. Lastly, one of the participants suggested a possible remedy for this issue which can be implemented through better communication. The participant explained that better communication between students and teaching assistants could help reduce stress. Furthermore, improved communication between peers can also significantly help students feel relaxed for an exam and solve course queries.

4.4 Course type and requirements

This dimension is based on the course types and their contents. We have used 2 questions to find the results for this dimension. The mean value obtained was 5.30, and the variance was 5.46. The range of this dimension was 5.15 to 5.46, and the Cronbach's alpha value was 0.53. We have achieved a comparatively lower Cronbach's alpha value as the participants can rate one of the questions higher as it generates more stress during an exam. Moreover, the participants can rate the second question much lower as it does not cause exam stress. This is because the participants can only find one of the questions to be a relevant factor for exam stress and the other question to be neutral or irrelevant. Furthermore, we then used the interview data to get more insights. We found out that all students agree that the difficult courses create more stress than less difficult ones. The higher the difficulty level of a course, the more stressed the participants have felt. For easier courses, however, the participants did not feel stressed as there were fewer concepts to learn or if it was too easy to pass a course. In relation to this, one of the interviewees stated, "There's just two courses that I have taken. And it's easy in the sense that it's hard to fail the exam. So in that case, I wouldn't feel any stress."

Additionally, the program requirements can play a significant role in exam stress. In our interviews, 4 out of 5 participants believe that it is one of the important reasons to create a lot of stress during exams. The reason for this is the heavy workload and high program intensity. The dense requirements of the university can make students feel overwhelmed and affect their performance during exams. Multiple requirements to pass a subject, such as assignments, exams, and homework, can engulf students. Similarly, the credits and thesis requirements add up to the exam pressure. The stress produced due to the variety of course requirements can be persistent in the initial phases for some students. Still, it can be prolonged for some students as well. Only 1 of the 5 participants did not consider this a reason for exam stress. This is because the participant had backups apart from this course. The participant believed that if this creates an inconvenience in the longer term, they could leave the study program as they did not have a high monetary investment.

4.5 Knowledge gained

This dimension consists of 3 questions, focusing on the knowledge gained through the courses and the application of exam strategy in the courses. After analyzing the survey responses for this dimension, we observed a mean of 4.70 and a variance of 2.20. The range of this dimension was from 4.07 to 5.23, and Cronbach's alpha value was 0.40. The Cronbach's alpha value for this dimension is seemingly low. This can be because the participants have the proper knowledge about a concept. Still, their strategy to use that knowledge in the exam might be ineffective. In this case, the participants can provide a higher rating on one point and a low rating on the other question.

We then used the interview data to understand these insights further. 3 out of 5 participants claimed that the level of knowledge gained depends on a lot of factors. Some of the factors include the amount of time invested in the course, the requirement of a course, and the number of deadlines. All participants in the interviews agreed that the difficulty of the course material and the amount of workload needed to be managed simultaneously resulted in less preparation time for the difficult subjects. One of the participants stated that "I've always felt a bit overwhelmed as well, in this sort of very small achievements are on the way, but they

don't really matter, there's a lot of effort that you have to put in order for it to get a good grade overall outcome."

Furthermore, one of the participants also highlighted that due to the high amount of course requirements and deadlines during the exam periods they feel that it is not possible to pass an exam. This is mainly because of planning issues and limited time to gather ample knowledge before an exam. The interviewee stated, "Last semester I was just forced to fail a subject, and the number of assignments are really overloaded and planned in a way which is not really great. There is a difference between the study material and too many things to do too many things to study and not enough time. "

4.6 Understanding and conveying

This dimension consists of 2 questions which focus on the level of understanding the participants have achieved in a course. Moreover, we also focus on if the participants could use the learned information about the concepts if there was no pass or fail criterion. The results from the survey for this dimension gave us a mean value of 4.81 and a variance of 2.70. The range of this dimension was 4.76 to 4.96, and the Cronbach's alpha value was 0.34. The Cronbach's alpha value for this dimension is slightly lower than the satisfaction rate. This can be because the participants consider one question to be a relevant factor in generating exam stress. In contrast, the other question is not appropriate for them in relation to exam stress.

From the interview data, we observed that almost all participants agreed that if the courses do not have a fail or scoring criteria, the participants can explain the concepts much better. This is mainly because they do not have to meet the requirements. The participants do not feel pressured as they do not have anything at stake, reducing exam stress. Without the criteria and conditions, the participants can convey the information to their teachers and peers much better.

4.7 Retakes

This dimension is used to understand students' feelings during the first attempt and a retake. By this, we know if retakes generate more exam stress and why. The results from the survey data had a mean of 5.42 and a variance of 2.80. The range was between 4.65 and 6.40, and Cronbach's alpha value was 0.56.

Furthermore, 2 out of 5 participants in the interviews feel that retakes can be stressful and frustrating. This is usually because of the poor performance on the first attempt. One of the participants explained that the process of retaking an exam makes the participant question their skills and conceptual knowledge. This further makes them disturbed by having a lack of knowledge about a particular concept. Moreover, this creates a higher amount of exam stress as the participants are eager to learn the concept to improve their performance on the retake. The remaining participants in the interviews were neutral as they felt constant exam stress for both the first attempts and the retake.

4.8 Educational satisfaction

In this dimension, we just used one question to understand the level of satisfaction or content students feel by completing their exams. The mean value for this dimension is 4.54, the variance is 2.60, and the range lies between 4.22 and 5.80. During the interviews, the

participants explained that they felt satisfied with how they completed the courses. But almost all participants thought the program and course requirements could be demanding. The number of exams and assignments required can be challenging to handle and can be often overwhelming. Furthermore, we have gained knowledge of other factors that aid exam stress and students' overall satisfaction. These factors include self-requirements and standards students set for themselves, which are sometimes difficult to achieve. These high standards or grade requirements can create ample exam stress. One of the participants stated, "So I have some requirement for myself for my performance during the exam, but approaching the end of my study, I don't really have that requirement for myself. But before when I held that requirement, I feel way more stress than compared to now." Alternatively, the participant also gave us another surprising perspective that when they actually accept defeat in a given subject they do not feel stressed during the exam because they know what the outcome is and they do not expect to pass with a good grade.

4.9 Persistence of stress

This dimension consists of only one question. The idea behind this dimension is to get an idea if the persistence of exam stress is only during the initial phases of the study program or throughout the program. After analyzing the survey data results, we observed a mean score of 4.81, a variance of 3.80 and a range between 4.50 to 5.70.

Moreover, the interviews gave us more insights into this persistence of stress and its reasons. 4 out of 5 participants feel that the persistence of stress is usually throughout the study program. One of the participants claimed the opposite: they felt the stress only at the start of the program as they had high expectations from themselves at the beginning. But as soon as they stopped setting challenging expectations from themselves and the new goal was to pass a subject, they started feeling less stressed. Some participants think the stress is a bit reduced as they get an idea about the exam types and course requirements. But, overall, the participants do feel that exam stress is continuously present throughout the program, irrespective of their familiarity with the study or exam methods.

4.10 Expertise in the field

This dimension consisted of one question. This dimension was created to understand how students feel about self-developing continuously to remain an expert in the field. The mean score of this dimension was 5.88, the variance was 3.84, and the range lay between 4.05 and 6.58. Although this dimension gives us the idea that students feel that keeping their skills polished is essential in Computer Science, we find this dimension less informative than others.

4.11 Remedies

To tackle the issue of exam stress, the participants suggested some techniques and initiatives. One of the participants indicated that a reduction in the course load could help reduce exam stress. By reducing the load and the course requirements, students can invest more time in preparing for an exam and feel less stressed during an exam. On the other hand, another participant felt that it is healthy and a sign of an active mind that a student feels a bit stressed during or before an exam. The participant added, however, that if these emotions go out of hand, getting in touch with a student coach or counsellor would be a suitable way

Dimension	Mean	Variance	Range	Cronbach's Alpha
Overall stress	5.01	2.80	4.07 - 5.57	0.89
Exam type	4.30	3.20	3.57 - 5.11	0.66
Background Knowledge	5.40	2.30	4.96 - 6.15	0.72
Course type and requirements	5.30	5.46	5.15 - 5.46	0.53
Knowledge gained	4.70	2.20	4.07 - 5.23	0.40
Understanding and conveying	4.81	2.70	4.76 - 4.96	0.34
Retakes	5.42	2.80	4.65 - 6.40	0.56
Educational satisfaction	4.54	2.60	4.22 - 5.80	-
Persistence of stress	4.81	3.80	4.50 - 5.70	-
Expertise in the field	5.88	3.84	4.05 - 6.58	-

Table 2: Observed values of each survey dimension

to get some perspective about things. Similarly, another participant suggested incorporating more descriptive and open-ended questions in the exams. The interviewee considered these questions less stressful during exams because they helped them provide a holistic view of what they had learned. Additionally, they can integrate all the knowledge achieved throughout the course with practical and theoretical knowledge to frame their answers. Lastly, one participant also suggested secluding the exam period to focus only on exams. This means the students can invest all their time in gathering as much knowledge as possible, simultaneously reducing exam stress. The participant stated, "I think the only way to remedy this issue is to keep the exam weeks actually sacred. So there are no last-minute deadlines for the exam week so we can actually focus on the exam rather than assignments and assignments deadlines can we actually figure it out before or after."

5 Conclusion and Discussion

In this study, we explored the experiences of Computer Science students during exams. Our primary focus was to understand the factors that create exam stress, the role of gender stereotypes, and how these factors affect the students' performance in an exam. We used two different methods to collect the data for the study. The survey included 26 participants with an almost equal male-to-female ratio, whereas the interviews were conducted with 5 participants, which had 3 males and 2 females.

5.1 General experience stress

According to the survey data, most students feel stressed and anxious when appearing for an exam. A study [34] also suggests that in all fields, most college students feel stressed when appearing for an exam based on many factors. Our findings show that students have a high amount of stress before or while they appear for an exam due to factors like personal requirements, academic requirements, course workload, and the newness of a concept. We used the interview data to get more context about the factors and how they play a role in exam stress. A study [28] based on the internal and external factors that affect students' academic performance also explains that the effect of exam stress can differ amongst students. Adding our findings, we found that students feel exam stress and anxiety because of subjective reasons, which can vary from student to student.

It became clear that five factors are most important regarding exam stress. For the first factor, i.e. background knowledge, our findings showed that students tend to be more stressed when they have limited or no knowledge about a concept. Our survey participants scored relatively high for this dimension. Similarly, the interviewees also explained the experience of higher exam stress for new concepts and courses. Especially international students or students with different educational backgrounds experience a relatively high amount of exam stress due to new courses and the program format. The second important factor that affects students' performance is the prevalence of exam stress. Our results indicate a high mean value for this dimension which explains that most participants feel stressed throughout the study program. In line with this, several studies have stated that the prevalence of stress amongst students fluctuates in nature and can vary amongst students [15][33]. Overall, the difference in background knowledge can play a substantial role in the prevalence of exam stress. When the background knowledge is limited, the exam stress is persistent throughout the program as the concepts encountered are continuously new and challenging.

The third factor that affects exam stress and anxiety is the difficulty of a course. Our findings show that when the courses are difficult, the amount of exam stress amongst students is considerably high. This factor works in relation to the time required to prepare for an exam. According to the insights we found in the interviews, most students feel that the time to prepare for a course is often less, which creates or increases exam stress. Similar to our findings, previous research [50] shows that lack of preparations, multiple deadlines, and high course requirements can significantly generate exam stress. The fourth factor that causes exam stress is understanding a concept. Our findings indicate that when concepts are understood thoroughly, the exam stress-induced is considerably low. The additional consequence of understanding a concept thoroughly includes students' performance in an exam, educational satisfaction, and better conveying of the knowledge gained. Continuing on this point, our results also show that students can convey knowledge and answer exam questions better without a pass or fail

criteria. Similarly, previous research [18] also suggests that non-graded assessments are better for learning and conceptual understanding. Ultimately, the difficulty level of a course and the time invested in preparing and understanding the concepts can act as a factor in generating exam stress. Due to the limited time and multiple course requirements, the preparations are often compromised, which stimulates exam stress.

Lastly, the fifth factor that generates exam stress is self-requirements. According to our results, students feel more stressed when setting high expectations for themselves. These high standards can instigate a feeling of stress and pressure before or during an exam. In relation to our finding, earlier works also [28] suggest that self-demands and goals can add to the pressure students feel during exams. Apart from these significant reasons, we also found some minor reasons that generate exam stress. These reasons include mental health issues like anxiety, depression, and retaking exams. Our findings indicate that poor performance in the first attempt of an exam can instil frustration, self-doubt, and lower confidence levels in students. These feelings can generate exam stress and affect the performance of some students during exams. Similar opinions [39][9] mention some symptoms of disappointment in an exam can affect cognitive functions and decision-making. Overall, self-requirements and mental health can be important factors in generating exam stress. High requirements can create more pressure and simultaneously affect a student's anxiety levels, affecting the overall performance in an exam.

Interestingly, our results also indicate that the type of exam assessment does not generate exam stress. These findings align with the literature [62], which also specifies that the nature of assessment does not play a role in developing exam stress. Overall, the five significant factors are important in generating exam stress. The way they play a role in developing exam stress can be subjective for each student. Still, the ultimate consequence of this is the affected performance of students during exams.

5.2 Experienced role of gender

The topic of gender has also been a prime focus in this study due to the underrepresentation of women in the field of Computer Science, the gender stereotypes that dissuade women from choosing Computer Science as a career path, and the stereotypical threat that make the field of Computer Science inclined towards male dominance [7][52][17]. After analyzing the surveys, we found that the average stress for females is higher than that for men. Other findings [49] on this topic also suggest that the stress produced in females is considerably higher along with some elevated body symptoms such as heartbeat. Furthermore, from the interview data, we noticed that females do not feel any bias directly in Computer Science at Leiden University. However, some stereotypes are prevalent, affecting females in the field of Computer Science. Sometimes there is a strange feeling for the female students when the classes are skewed with a high ratio of men. The students, however, do not feel any differentiation; there is a sub-conscious stigma that affects females.

Adding to this, there are also times when the older generations do feel that their female children are very talented in doing this kind of study. Even though there is no bias between the two genders, some stereotypical stress pertains. Similarly, previous work [56][4] in these areas also suggests these stereotypical threats from parents and elders are present in Computer Science. Even though the situation is not so extreme as to affect the performance of the female students, it does sometimes affect the minds of the female students. Furthermore, in several situations and observations made by the male participants, females seem more

stressed during exams. Previous work [49] also suggests a similar observation in the case of females participating in an exam. Lastly, according to some instances, there was some gender bias observed at other universities where female participants were only allowed to do the drafting work for assignments. In line with our findings, previous work [44] also suggests some consequences of stereotypic threat, including an imbalance in team decisions and judgment. We also found that the last dimension, which focuses on the kind of expertise required continuously to remain an expert in the field, was not very informative. Overall, gender stereotypes add pressure experienced by females in Computer Science. This pressure consequently affects the self-expectations and self-efficacy of female students. Additionally, these experiences can be a basis for prospective female candidates to choose Computer Science as a career path.

5.3 Future work and Limitations

For future studies, it would be valuable to continue this study on a larger scale. We want to investigate a larger group of students, mainly from other universities, to elaborate further and substantiate our findings on how people feel during an exam. Another possible future direction for this study would involve more participants from bachelor's and master's courses. By including more students from these areas of study, we can gain insights into how age plays a role in the experiences during an exam. Lastly, incorporating other genders in this study can also be a clear point. The involvement of non-binary and third genders in this research can help us gain details about the experiences of these gender classes. Under normal circumstances, these genders face many biases and stereotypes. By incorporating these genders in the study, we can analyze if there is any bias prevalent in the field of Computer Science as well.

The study also entails some limitations. One limitation of the study is the small group of participants that took part and the study being limited to only one university. The limited number of participants can be an issue as the responses and perspectives that are collected are very few. Moreover, as the study only incorporates students from one university, we risk differences in opinion amongst students of different universities. Finally, the last limitation is the validation of the survey. Even though most of the items in the survey are extracted from existing questionnaires, our survey remains self-developed and is not a validated research instrument.

5.4 Conclusion

The responses and results indicate that exam stress exists in Computer Science students. The nature and factors vary amongst students, but these factors indeed affect students' performance during exams. Similarly, the stress is higher for female students than male students. Although there are no prevalent gender biases, some stereotypes play a role in affecting the stress level of females. Lastly, the students themselves have suggestions for remedies that can be implemented to improve their experience during exams and improvise the environment for females in Computer Science.

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7 Appendix

7.1 Survey

Please indicate the extent to which you agree with the following statements on a scale of 1 (strongly disagree with the statement) to 7 (strongly agree with the statement).

(Using a scale of 1-7 to answer the questions: 1- Strongly disagree, 2- Disagree, 3- Somewhat disagree, 4- Neutral, 5- Somewhat agree, 6- Agree, 7- Strongly agree)

Q1. I feel nervous when appearing for an exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q2. I feel high amount of stress and pressure before an exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q3. I get a feeling of anxiety before an exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q4. I feel that exams give me a feeling of being uneasy and affect my body symptoms and behaviors (for example sweating, increased heartbeat, etc.).

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q5. I feel that exam stress reduces my performance during the actual exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q6. I feel more stressed when appearing for an online exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q7. I believe that objective questions (MCQ's) are better than subjective ones (reasoning).

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q8. I believe that oral exams are more stressful.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q9. I believe the exams get easier when teachers improve their methods of teaching.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q10. I experience that less preparations and insufficient background knowledge create more stress in my mind when appearing for an exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q11. I believe that assignments/ mini projects would be a better grading criterion instead of a final exam.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q12. Good assignment performance and grades create less stress when I appear for an exam for the same subject.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q13. I think that the exams are easier when the subjects have coding aspects to it.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q14. I find purely theoretical subjects better when it comes to exams.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q15. In general, I am satisfied with the way I complete my exams.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q16. I think that prior knowledge in CS makes exams easier.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q17. If my teacher asks me to answer the same concept after exam, I will be able to answer it better.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q18. I feel that I have gained a better understanding of concepts in my courses with the kind of exam assessments.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q19. I feel that I must constantly learn to become and remain an expert in my field.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q20. I believe that the exam strategy I have applied in courses where I have received a good grade will also work on new courses.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q21. I feel the exam stress persistent to the start of the study program and it is even present in the later semesters as well.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q22. I find retaking exams makes it less stressful as I have attempted the same subject exam before.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q23. I feel that retakes generate a higher amount of stress in me as I have performed poorly once.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

Q24. If I was asked the exam questions without a pass/fail criterion I could answer it better.

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree

7.2 Interview

Q1. Can you share some ideas about how you feel before an exam? Do you feel stressed, nervous?

-If yes, then why?

- Do you have a personal experience about this lately?

- If no, can you explain how you then feel before an exam (for example, calm because prepared, calm because you don't care so much)?

Q2. In our research we are also interested in how gender could possibly have a role in the experience of stress as there are some stereotypes and considerations of CS as more of a masculine field (70). Although there seems a high interest of women in the coming years (71), it's still an intriguing topic and I would like to speak to you on the same.

Do you think that gender has a role to play in stress for CS students?

- If yes, then why/how?

- Do you have a personal experience to which you can relate to?

- Do you feel that this bias that you feel exist affects your performance during an exam? If so, how?

- If no, can you explain why you feel gender would not have a role?

Q3. Do you feel that differences in education systems between your prior and current course add on to the stress during exams?

- For example, for international students the layout of the program, the criterion to complete the course is different. For instance, in my bachelor's university the passing grade was 40/100 but here it is 55/100, credits weren't a matter of concern for me as it wasn't a very important factor, whereas these nuances are very much similar for people who have done their bachelor's in the Netherlands.

- Do you feel that the difficulty level of your course or the requirement of the program affects your stress level during exams?

- If yes, then how? If no, then why not?

Q4. Do you think there are ways to remedy this issue of exam stress?

- If yes, then what can be the solution?

- How can we implement this remedy?

- If no, then why do you think there is no solution for this?

Q5. Do you have any other comments or questions about this topic before we close the interview?