



THE UNIVERSITY OF WESTERN AUSTRALIA

Achieve International Excellence

Computer Science and Software Engineering

SEMESTER 1, 2015 EXAMINATIONS

**CITS5501
Software Testing and Quality Assurance**

FAMILY NAME: _____ GIVEN NAMES: _____

STUDENT ID:

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 SIGNATURE: _____

This Paper Contains: **6 pages (including title page)**
Time allowed: **2:10 hours (including reading time)**

INSTRUCTIONS:

TOTAL MARKS: **60 MARKS**

- Candidates should attempt all four of the questions.
- Each question is worth FIFTEEN (15) marks.
- Please start each question on a new page.
- Please use a black or blue ink pen. Do not answer questions in pencil.

NOTE: This is a closed book examination.

Books, notes and calculators may NOT be taken into the examination room.

Exam papers are to be collected with the examination answer booklets.

PLEASE NOTE

Examination candidates may only bring authorised materials into the examination room. If a supervisor finds, during the examination, that you have unauthorised material, in whatever form, in the vicinity of your desk or on your person, whether in the examination room or the toilets or en route to/from the toilets, the matter will be reported to the head of school and disciplinary action will normally be taken against you. This action may result in your being deprived of any credit for this examination or even, in some cases, for the whole unit. This will apply regardless of whether the material has been used at the time it is found.

Therefore, any candidate who has brought any unauthorised material whatsoever into the examination room should declare it to the supervisor immediately. Candidates who are uncertain whether any material is authorised should ask the supervisor for clarification.

Supervisors Only - Student left at:

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QUESTION 1

Surveys have shown that typically 40% of all defects in a software product originated from poor requirements elicitation and analysis. Requirements engineering is particularly dependent on people and their communications with each other (rather than on processes or technology). There can be substantial variation in how well the requirements are specified. Describe how a project manager should monitor and minimise such variation. Explain, in detail, how quality assurance principles are employed to significantly reduce the number of problems from the requirements engineering process.

(15 marks)

QUESTION 2

A bank tries to promote a life insurance policy as a package with their home loan scheme. They advertise that, by paying the premium, should the borrower die, the policy will pay off the loan. The premium is calculated annually at the beginning of each annual policy period and based on the loan balance at that time. The base annual premium will be \$1 for \$10,000 in loan balance. The system will increase the base premium by a certain percentage based on the following physical and health questions that the Telephone Banker will ask during the interview:

1. Have you smoked cigarettes in the past 12 months?
2. Have you ever been diagnosed with cancer, diabetes, high cholesterol, high blood pressure, a heart disorder, or stroke?
3. Within the last 5 years, have you been hospitalized for more than 72 hours except for childbirth?
4. Within the last 5 years, have you been completely disabled from work for a week or longer due to an illness or injury?

The Telephone Banker will enter the answers to these questions into a computer program. A 'Yes' answer to any of these questions will trigger a 50% increase to the base premium.

The Telephone Banker will also ask about the age, weight, and height of the applicant. If the age of the applicant is under 18, then the application is declined. Combining the weight and height of the applicant, a third party software package is used to calculate the body mass index (BMI). The Telephone Banker will enter the BMI into the computer program which implements the following rules:

| | | BMI | | | | |
|-----|-------|---------|-------|-------|-------|---------|
| | | < 18 | 18-33 | 34-36 | 37-39 | > 39 |
| Age | 18-39 | Decline | 0% | 75% | 100% | Decline |
| | 40-59 | Decline | 0% | 50% | 75% | Decline |
| | > 59 | Decline | 0% | 25% | 50% | Decline |

The increases in base premium are cumulative, e.g., if the applicant has normal weight, smokes cigarettes, and has high blood pressure, the annual rate is increased from \$1 per \$10,000 to $\$(1 + 0.5)^2 = \2.25 per \$10,000. If a person is 45 years old with diabetes and BMI = 39, then the annual rate is $\$(1 + 0.5) \times (1 + 0.75) = \2.625 per \$10,000.

The computer program must be highly reliable to produce the correct annual rates for different applicants. As a tester of the computer program, describe what test strategy you would use to ensure the quality of the program. Your strategy should include at least 3 test criteria. Justify why you chose these criteria. A test case or scenario demonstrating the principle should be given for each test criterion.

(15 marks)

QUESTION 3

Professional tennis players must participate in a number of tournaments each year. Each tournament involves matches that are grouped into *rounds* and each round has a designated point value, e.g., major tournaments, such as the *Australian Open* and *US Open*, award 2000 points to the winner and 1200 points to the runner-up in the final round, 720 points to the players who reach (but lose in) the semi-final round, and so on. The Association of Tennis Professionals (ATP) records the performance of all professional tennis players and, based on the data, determines the world ranking of these players.

In this question you are to build a formal Z specification for managing some of the data maintained by ATP. The sets that should be used in the specification are:

- **Person**: the set of all players
- **Name**: the set of names of all tournaments
- **Round**: the set of rounds
- **Year**: the set of years
- **N**: the set of natural numbers

The static schemas that you should define are:

- **TournamentDB**: this should record the names of all the tournaments and the point values for different rounds in each tournament. To distinguish the different point values awarded to the winner and the runner-up in the final round, a *winner* round is used to associate the point value awarded to the winner.
- **Tournaments**: this should record the names of all the tournaments. Also should be recorded are the years and the winners of the tournaments.
- **PlayerDB**: this should record a list of all the professional tennis players and the tournaments participated by each player and the round they reached in each tournament in each year.

The dynamic schemas that you should define are:

- **AddPlayer**: given a new player (e.g., when a junior tennis player turns professional), this schema should add the player to the ATP system.
- **RemovePlayer**: given an input player who decides to retire from playing professional tennis, this schema should remove all the records about the player from the ATP system.
- **AddTournament**: given the name, year, and winner of a tournament, this schema should add the tournament data to the ATP system.
- **ComputePoint**: given a player, the name and year of a tournament that he participated in, this schema should return the round that he reached and the point value that he earned.
- **FindNumberOfWins**: given an input player and the name of a tournament, this schema should return the number of times the player won the tournament.

(15 marks)

QUESTION 4

If you were a project manager in a software company which is about to build its first safety critical system, list some initiatives which you would like to see in place before starting. The project is the design and implementation of an automated railway signalling system. Discuss how you might go about ensuring a high degree of reliability and safety. For example, you could consider “fail-safing”, “fault tolerance” or “formal proofs of correctness”. However, you might also consider measurements based on testing history. Describe how you would measure the reliability in order to certify that the system is safe, prior to installation.

(15 marks)

END OF PAPER
