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|  | | | High Integrity Software DevelopmentCOURSEWORK REPORT | | | | | | | | | |  | | | |
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|  | | | | | | DATE 12/12/2019 | | |  | | | | | | | |
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|  | | | | TAKS 1: CODE ANALYSIS | | | | | | |  | | | | | | |
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|  | INFORMATION FLOW In the specification file in order to declare the dependency between the procedure’s variables, depends clauses were used. More specifically, in the first procedure of the exercises.ads file (Calc) variable Result can depend on the Cost variable hence adding Depends => (Result => Cost) is mandatory. Similarly, in the next procedure Quantity value is multiplies by a constant and is assigned to Charge so this Depends => (Charge => Quantity) had to be added. For the rest procedures, the same pattern follows but since both write on an array it must be clarified that the array return value is depending on the index of the array and the already content of itself. This is done by the following lines Depends => (A => (A,B,C)) & Depends => (Target => (Target,Mask)) on the Modify & MarkSequence procedures correspondingly. | | | | | | | | | | | | | | |  | |
|  | CORRECTING RUN-TIME ERRORS Many run-time errors appeared when tried to run the proof tools of SPARK for the given project. As it can be seen in the picture attached below, these errors had to do mostly with overflows, array indexes and unititialized variables.    In order to fix the second error in the list of the picture, Charge local variable had to be initialized in the .adb file so the declaration of the variable was changed to this line : Charge: Integer := -1; ADDITION OF PROOF ASPECTS Pre & Post aspects should be introduced not only to restrict the input & output values of our procedures and to verify their results. In detail the following steps were taken in .ads file for each procedure:   * Calc : Since we multiply Cost with 100 we must check if the result does not overflow so we add this Pre statement Pre => (Cost < Integer'Last / 100 and then Cost > Integer'First / 100). As far as the result of this procedure a Post aspect had to be added to eliminate the possibility of assigning an undefying value to the Result variable this adding this line prevented this Post => (Result = -1 or Result = Cost \* 100). * CalculateCharge: As explained above for the same reasons Pre and Post aspects had to be introduced to tackle similar overflow and unknown value errors. Pre => (Quantity < Integer'Last / 5000 and Quantity > Integer'First/5000), Post => (Charge = Quantity \* 5000); * Modify: The primary goal was to find the right Pre condition that could fit every possible combination of B + C that wouldn’t overflow the system and still be in the range of Size. For that specific task this complicated pre aspect was written   Pre => ((C < Integer'First and B < Integer'First and B > Integer'Last and C > Integer'Last) and then (B + C > Integer'First - Size'Last and B + C < Integer'Last + Size'Last) and then B + C > 0 and then B + C < Size'Last). Once again it is checked that the final value is indeed correct Post => (A(B+C) = 40)   * MaskSequence: For this one the proof tool had to deal with checking every single array value so for all keyword was used. In the Pre aspect, both arrays length are checked if they are within the range of Size and then every element of Target Array is checked if it is less than the maximum integer value and then if all values of Mask array are either 1 or 0.   Pre =>(Target'Length in Size'Range and Mask'Length in Size'Range and (for all I in Size'Range =>Target(I) < Integer'Last and then (Mask(I) = 1 or Mask(I) = 0)))  For the Post condition the final values of the Target array are verified that have been assigned the desired value.  Post => (for all I in Size'Range => (Target(I) = Target(I) \* Mask(I))) | | | | | | | | | | | | | | |  | |
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|  | TASK 2: WEAKEST PRECONDITIONS | | | |  | |
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|  | PROOF OF VERIFICATION | | | | |  | |
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