# PROGRAMMING TASK

In this homework, you are supposed to implement a Java program for a hospital database by using binary search trees. You must use your own implementation of binary search trees by taking inspiration from your textbook or the web. You are not allowed to use any external library or .jar file.

In this hospital database, for each patient, you will have an entry in which you keep:

1. The first name and last name of the patient,
2. Date the patient visited the hospital (month, day, and year),
3. The first name and last name of the doctor,
4. A list of its patient’s care team. For each medical staff member in the hospital, you should keep:
   1. The first and last name of a medical staff member, and
   2. The professional role they fulfill (Nurse, Anesthesiologist, etc.).

In your implementation, you must keep patient entries in the binary search tree based on the year the patient visited the hospital. Then, to keep the care team of each patient, you should create a binary search tree in which the medical staff members are kept by their names (e.g., if you have five patients in your binary search tree, you will have five more binary search trees: one for the care team of each patient.). To deal with patients of the same year, you can define your binary search tree for a node such that elements with smaller values are kept in the left subtree of the node, and elements with larger or equal values are kept in its right subtree.

Your system will have the following functionalities; the details of these functionalities are given below (see the end of this document for sample inputs/outputs):

1. Add a patient
2. Remove a patient
3. Add a medical staff member to the care team of a patient
4. Remove a medical staff member from the care team of a patient
5. Show the list of patients
6. Show detailed information about a particular patient
7. Query the patients who were seen by a particular doctor
8. Query the patients who visited in a given year

**Add a patient**: This function adds an entry to the hospital database for a given patient whose name

(first name + last name), doctor’s name (first name + last name), and visit date (day + month + year) are specified as parameters. In this function, the care team is not specified; the medical staff members that cared for the patient will be added later. In this system, the names (first name + last name) of the patients are unique. Thus, if the user attempts to add a patient with an existing name, you should overwrite old information.

**Remove a patient**: This function removes a patient, whose name is specified as a parameter, from the hospital database. If this patient does not exist in the database (i.e., if there is no patient with a specific name), you should not allow this operation and give a warning message.

**Add a medical staff member**: This function adds a medical staff member to the care team of a patient. For that, the name of the patient to which the medical staff member is added, the medical staff member’s name (first name + last name), and the title of the professional role fulfilled by the medical staff member are specified as parameters. In this function, you should consider the following issues:

• If the patient with a specific name does not exist in the database, you should not allow the operation and give a warning message. • In this system, all medical staff members’ names are unique within the same care team. Thus, if the user attempts to add a medical staff member with an existing name **within the same care team**, you should overwrite old information. **Please note that a medical staff member can work in different care teams.**

**Remove a medical staff member**: This function removes a medical staff member from the care team of a patient. For that, the name of the patient from which the medical staff member is removed and a medical staff member’s name (first name + last name) are specified as parameters. If the patient with a specific name does not exist in the database, you should not allow the operation and give a warning message. Similarly, if the medical staff member is not in the care team of the specified patient, you should not allow the operation and give a warning message. Note that after calling this function, the care team should remain sorted in ascending order.

**Show the list of patients**: You should list all patient entries in the hospital database on the screen in the following format. If the database does not contain any patient, you should display -

--none---. Your system should display patients in **ascending** order by visit year.

Name(First name + Last Name), visit year, doctor name (for the 1st patient)

Name(First name + Last Name), visit year, doctor name (for the 2nd patient) Name(First name + Last Name), visit year, doctor name (for the 3rd patient)

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**Show detailed information about a particular patient**: You should display all of the information about a patient whose name is specified as a parameter. The output should be in the following format where the medical staff member’s names should be sorted in alphabetically ascending order. If the patient with a specified name does not exist in the database, you should display -

--none--- after the title. Your system should display medical staff member names in **ascending** order by member name.

Name(First name + Last Name)

Visit day/ Visit month/ Visit year

Doctor name (first name + last name)

Medical Staff Member name, the title of his/her professional role (for the 1st medical care staff)

Medical Staff Member name, the title of his/her professional role (for the 2nd medical care staff)

Medical Staff Member name, the title of his/her professional role (for the 3rd medical care staff)

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**Query the patients that were seen by a particular doctor**: You should list all patients seen by the doctor whose name (first name + last name) is specified as a parameter. The output should include the names and the visit dates of the patients and should be in the following format. Note that if the doctor did not see any patient, you should display ---none--- after the name of the doctor. Your system should display patients in **descending** order by visit year.

Doctor name

Patient name, visit day / visit month / visit year (for the 1st patient)

Patient name, visit day / visit month / visit year (for the 2nd patient)

Patient name, visit day / visit month / visit year (for the 3rd patient)

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**Query the patients who visited in a given year:** You should list all patients visited in the year which is specified as a parameter. The output should include the names of the patients, the doctor names, and visit dates, and should be in the following format. Note that if there is no patient in the specified year, you should display ---none--- after the visit year. Your system should display patients in **descending** order by visit year.

Visit year

Patient name, visit day / visit month (for the 1st patient)

Patient name, visit day / visit month (for the 2nd patient) Patient name, visit day / visit month (for the 3rd patient)

The name of the class must be HospitalDatabase, and must include the following public member functions. These functions will be used to test your code. You can also define additional classes in your solution.

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| --- |
| public class HospitalDatabase {  HospitalDatabase();  public void addPatient(String patientName, String doctorName, int visitDay, int visitMonth, int visitYear); public void removePatient(String patientName);  public void addMember(String patientName, String memberName, String memberRole); public void removeMember(String patientName, String memberName); public void showAllPatients(); public void showPatient(String patientName); public void showDoctorPatients(String doctorName); public void showPatients(int visitYear);    }; |

**Example Test Code**:

Below is an example of the test code that can be used for testing your programs. Of course, we will use other test codes in grading. Thus, do not forget to test your program with different test codes as well.

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| public static void main(String args[])  {  HospitalDatabase hd = new HospitalDatabase();    hd.showAllPatients();    hd.addPatient("Michael Johnson","Emma Thompson", 19, 12, 2022); hd.addPatient("Ethan Lee", "Olivia Sanchez", 8, 9, 2020); hd.addPatient("Noah Miller", "Olivia Sanchez", 27, 2, 2019); hd.addPatient("Liam Davis", "Isabella Martinez", 3, 4, 2022); hd.addPatient("Ava Taylor", "Isabella Martinez", 15, 5, 2024); hd.addPatient("Mason Moore", "William Anderson", 7, 6, 2021); hd.addPatient("Charlotte Garcia", "Lucas Lewis", 30, 10, 2023); hd.addPatient("Noah Miller", "Olivia Sanchez", 27, 2, 2019);    hd.showAllPatients(); hd.removePatient("Ava Taylor"); hd.showAllPatients(); hd.showPatient("Michael Johnson"); hd.addMember("Mason Moore", "Daniel Roberts", "Nurse"); hd.addMember ("Mason Moore", "Victoria Stewart", "Radiologist"); hd.addMember ("Mason Moore", "Tyler Campbell", "Medical Assistant"); hd.addMember ("Mason Moore", "Hannah Martin", "Paramedic"); hd.addMember ("Michael Johnson", "Jack Allen", "Patient Care Technician"); hd.addMember ("Michael Johnson", "Oliver Nelson", "Anesthesiologist"); hd.addMember ("Michael Johnson", "Sophia Rivera", "Pathologist"); hd.addMember ("Michael Johnson", "Evan Hall", "Laboratory Technician"); hd.addMember ("Michael Johnson", "Megan Price", "Nurse"); hd.addMember ("Ava Taylor", "Brianna Reed", "Dietitian"); hd.addMember ("Charlotte Garcia", "Oliver Nelson", "Anesthesiologist"); hd.addMember ("Charlotte Garcia", "Trevor Jenkins", "Medical Equipment Technician");  hd.addMember ("Charlotte Garcia", "Justin Flores", "Speech-Language Pathologist");  hd.showPatient("Mason Moore"); hd.showPatient("Michael Johnson"); hd.removeMember("Michael Johnson", "Evan Hall"); hd.showPatient("Michael Johnson"); hd.showDoctorPatients("Olivia Sanchez"); hd.showDoctorPatients("Emma Thompson");  hd.showPatients(2022); | |
| } | System.exit(0); |

**Output of the Example Test Code**:

For the test code that is given above, you will see the following output on the screen.

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| ---none---    INFO: Patient Michael Johnson has been added  INFO: Patient Ethan Lee has been added  INFO: Patient Noah Miller has been added  INFO: Patient Liam Davis has been added  INFO: Patient Ava Taylor has been added  INFO: Patient Mason Moore has been added  INFO: Patient Charlotte Garcia has been added  ERROR: Patient Noah Miller overwritten  Noah Miller, 2019, Olivia Sanchez  Ethan Lee, 2020, Olivia Sanchez  Mason Moore, 2021, William Anderson  Liam Davis, 2022, Isabella Martinez  Michael Johnson, 2022, Emma Thompson  Charlotte Garcia, 2023, Lucas Lewis  Ava Taylor, 2024, Isabella Martinez  INFO: Patient Ava Taylor has been removed    Noah Miller, 2019, Olivia Sanchez  Ethan Lee, 2020, Olivia Sanchez  Mason Moore, 2021, William Anderson  Liam Davis, 2022, Isabella Martinez  Michael Johnson, 2022, Emma Thompson  Charlotte Garcia, 2023, Lucas Lewis  Michael Johnson  19/12/2022  Emma Thompson    INFO: Daniel Roberts has been added to the patient Mason Moore  INFO: Victoria Stewart has been added to the patient Mason Moore INFO: Tyler Campbell has been added to the patient Mason Moore INFO: Hannah Martin has been added to the patient Mason Moore  INFO: Jack Allen has been added to the patient Michael Johnson  INFO: Oliver Nelson has been added to the patient Michael Johnson  INFO: Sophia Rivera has been added to the patient Michael Johnson  INFO: Evan Hall has been added to the patient Michael Johnson |
| INFO: Meghan Price has been added to the patient Michael Johnson  ERROR: Patient Ava Taylor does not exist  INFO: Oliver Nelson has been added to the patient Charlotte Garcia  INFO: Trevor Jenkins has been added to the patient Charlotte Garcia  INFO: Justin Flores has been added to the patient Charlotte Garcia    Mason Moore  7/6/2021  William Anderson  Daniel Roberts, Nurse  Hannah Martin, Paramedic  Tyler Campbell, Medical Assistant  Victoria Stewart, Radiologist    Michael Johnson  19/12/2022  Emma Thompson  Evan Hall, Laboratory Technician  Jack Ellen, Patient Care Technician  Meghan Price, Nurse  Oliver Nelson, Anesthesiologist  Sophia Rivera, Pathologist    INFO: Evan Hall has been removed from the patient Michael Johnson  Michael Johnson  19/12/2022  Emma Thompson Jack Ellen, Patient Care Technician  Meghan Price, Nurse  Oliver Nelson, Anesthesiologist  Sophia Rivera, Pathologist    Olivia Sanchez  Ethan Lee, 8/9/2020  Noah Miller, 27/2/2019    Emma Thompson  Michael Johnson, 19/12/2022    2022  Michael Johnson, 19/12  Liam Davis, 3/4 |