Name: Abraham Alfred
Username: alfredabra
ID: 300509598

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Abraham Alfred

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Username: alfredabra
ID: 300509598

Q1) (5 Marks) Represent the policy using an access matrix. Associated rights are based on UNIX access rights and include: Read, Write and Execute. This must include identification of all subjects/objects and appropriate privileges/permissions.

Files	File 1: sbasicinfo.log	File 2: pbasicinfo.log	File 3: pmedicalrecord.log
Administrators	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx
Doctors	Permission: r--	Permission: r--	Permission: rw- (Dependent on doctor r---)
Nurses	Permission: r--	Permission: r--	Permission: r--
Receptionists	Permission: r--	Permission: rw-	Permission: ---

Scripts	File 1: file-system.sh	File 2: staff-and-acls.sh	File 3: acls.sh
Administrators	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx
Doctors	Permission: ---	Permission: ---	Permission: ---
Nurses	Permission: ---	Permission: ---	Permission: ---
Receptionists	Permission: ---	Permission: ---	Permission: ---

Scripts	File 4: patients.sh	File 5: visit.sh	File 6: searchpatient.sh	File 7: audit.sh
Administrators	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx	*SUPERUSER* Permission: rwx
Doctors	Permission: r-x	Permission: r-x	Permission: r-x	Permission: ---
Nurses	Permission: ---	Permission: ---	Permission: r-x	Permission: ---
Receptionists	Permission: r-x	Permission: ---	Permission: r-x	Permission: ---

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Directories	WellingtonClinic	Staff	Scripts	Patients
Administrators	**SUPERUSER** Permission: rwx	**SUPERUSER** Permission: rwx	**SUPERUSER** Permission: rwx	**SUPERUSER** Permission: rwx
Doctors	Permission: r-x	Permission: r-x	Permission: r-x	Permission: r-x
Nurses	Permission: r-x	Permission: r-x	Permission: r-x	Permission: r-x
Receptionists	Permission: r-x	Permission: r-x	Permission: r-x	Permission: r-x

Q2) (5 Marks) Write a Bash/Python script (**file-system.sh**) to create the file system directory structure according to the information given in the case study. Only the administrators are able to execute this script.

NOTE: The file-system.sh file is currently saved in windows format. If you run the file, convert it to unix format first with the command "dos2unix file-system.sh" in the terminal. Otherwise it will not run.

```bash
!/bin/bash
# This script is for question 2

#Make the directory  folder inside the /opt/ directory
mkdir WellingtonClinic
        cd WellingtonClinic #go inside it
        mkdir staff         #Make this directory inside WellingtonClinic
        mkdir scripts        #Make this directory inside WellingtonClinic
        mkdir patients       #Make this directory inside WellingtonClinic
                cd staff    #go inside staff directory
                mkdir administrators    #Make this directory inside staff
                mkdir nurses            #Make this directory inside staff
                mkdir receptionists     #Make this directory inside staff
                mkdir doctors           #Make this directory inside staff
```

Q3) (10 Marks) Write a Bash/Python script (**staff-and-acls.sh**) to create the following staff and corresponding files associated with each. The script should illustrate (include) object creation and creation and/or modification of ownership. Only administrators are able to execute this script. 1. Mary Teresa, Date of Birth: 03/08/1953, Date Joined the clinic: 1997, Address: 173 Rnd street Kelburn, Email: m.theresa@yahoo.com, Phone: 04528293
2. Breana Kipling, Date of Birth: 03/08/1991, Date Joined the clinic: 2018, Address: 4548 River Road HugoTown Auckland 5513, Email: szzh8@tempmail.net, Phone:071943668

3. Mandy Dannel, Date of Birth: 15/12/1965, Date joined the clinic: 1993, Address: 343 Norma Avenue Dayton Napier 6731, Email: mandydl@gmail.com, Phone: 052637445

4. Lance Bourne, Date of Birth: 07/04/1970, Date joined the clinic: 2002, Address: 25 Ferguson Street Franklin Greytown 8567, Email: lancb@outlook.com, Phone: 083736456

Doctors:

- Nurses:

1. Lucia Blakeley, Date of Birth: 11/09/1980, Date joined the clinic: 2004, Address: 935 Massachusetts Avenue Hamilton 4562, Email: lucyblak@outlook.com, Phone: 38347463

2. Phil McGraw, Date of Birth: 15/04/1984, Date joined the clinic: 2008, Address: 45 Razyn Street Petone Lower Hutt 8435, Email: philmcg@gmail.com, Phone: 02384756

- Receptionist(s):

1. Andy Smith, Date of Birth: 13/09/1974, Date joined the clinic: 2002, Address: 58 Foster avenue Wellington 5011, Email: smith.andy74@gmail.com, Phone: 07284756

- **Administrator(s)**:

1. Pauline Sanderson, Date-of-Birth: 08/03/1993, Date-joined-the-clinic: 1995, Address: 2452 Randolph Street Bedford Auckland 7752, Email: paulsand@admins.co.nz, Phone: 03747543

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```bash
#!/bin/bash
# This file generates the staff and acls file system.

# Question 3
groupadd -f Administrators
groupadd -f Receptionists
groupadd -f Doctors
groupadd -f Nurses

cd /opt/WellingtonClinic/
cd staff
cd doctors

sudo usermod -a -G sudo Administrators
chmod -R 775 staff

echo ""
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+ This is the staff generator for the Wellington Clinic. +"
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo ""
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+                                                         +"
echo "+ The following groups and users will be generated. +"
echo "+                                                         +"
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo ""

echo "++++++++++++++++++++++++"
echo "+                      +"
echo "+       Doctors:       +"
echo "+ 1) Mary Teresa       +"
echo "+ 2) Breana Kipling    +"
echo "+ 3) Mandy Dannel      +"
echo "+ 4) Lance Bourne      +"
echo "+                      +"
echo "++++++++++++++++++++++++"

# Starts making the doctor users. Deletes them if they exist otherwise keeps things the same.

userdel mate1997
useradd mate1997
sudo mkhomedir_helper mate1997
usermod -a -G Doctors mate1997

mkdir -p mate1997
    cd mate1997
    touch sbasicinfo.log
```

```bash
49          >sbasicinfo.log
50          echo -n > sbasicinfo.log
51          printf 'Mary Teresa, Date of Birth: 03/08/1953, Date Joined the clinic: 1997, Address: 173 Rnd street Kelburn, Email: m.theresa@yahoo.com, Phone: 04528293' > sbasicinfo.log
52
53      chmod -R 774 sbasicinfo.log
54
55      cd /opt/WellingtonClinic/staff/doctors/
56
57      userdel brki2018
58      useradd brki2018
59      sudo mkhomedir_helper brki2018
60      usermod -a -G Doctors brki2018
61
62      mkdir -p brki2018
63          cd brki2018
64          touch sbasicinfo.log
65          >sbasicinfo.log
66          echo -n > sbasicinfo.log
67          printf 'Breana Kipling, Date of Birth: 03/08/1991, Date Joined the clinic: 2018, Address: 4548 River Road HugoTown Auckland 5513, Email: szzh8@tempmail.net, Phone:071943668' > sbasicinfo.log
68
69      chmod -R 774 sbasicinfo.log
70
71      cd /opt/WellingtonClinic/staff/doctors/
72
73      userdel mada1993
74      useradd mada1993
75      sudo mkhomedir_helper mada1993
76      usermod -a -G Doctors mada1993
77
78      mkdir -p mada1993
79          cd mada1993
80          touch sbasicinfo.log
81          >sbasicinfo.log
82          echo -n > sbasicinfo.log
83          printf 'Mandy Dannel, Date of Birth: 15/12/1965, Date joined the clinic: 1993, Address: 343 Norma Avenue Dayton Napier 6731, Email: mandydl@gmail.com, Phone: 052637445' > sbasicinfo.log
84
85      chmod -R 774 sbasicinfo.log
86
87      cd /opt/WellingtonClinic/staff/doctors/
88
89      userdel labo2002
90      useradd labo2002
91      sudo mkhomedir_helper labo2002
92      usermod -a -G Doctors labo2002
93
94      mkdir -p labo2002
95          cd labo2002
96          touch sbasicinfo.log
97          >sbasicinfo.log
```

```bash
98          echo -n > sbasicinfo.log
99          printf 'Lance Bourne, Date of Birth: 07/04/1970, Date joined the clinic: 2002, Address: 25 Ferguson Street Franklin Greytown 8567, Email: lancb@outlook.com, Phone: 083736456' > sbasicinfo.log
100
101     #give the right permissions for the sbasicinfo.log file.
102     chmod -R 774 sbasicinfo.log
103
104     #change directory and make the nurses users. Deletes them if they exist otherwise things stay the same.
105     cd /opt/WellingtonClinic/staff/nurses/
106
107     echo "+++++++++++++++++++++++"
108     echo "+                     +"
109     echo "+       Nurses:       +"
110     echo "+ 1) Lucia Blakeley   +"
111     echo "+ 2) Phil McGraw      +"
112     echo "+                     +"
113     echo "+++++++++++++++++++++++"
114
115     userdel lubl2004
116     useradd lubl2004
117     sudo mkhomedir_helper lubl2004
118     usermod -a -G Nurses lubl2004
119
120     mkdir -p lubl2004
121         cd lubl2004
122         touch sbasicinfo.log
123         >sbasicinfo.log
124         echo -n > sbasicinfo.log
125         printf 'Lucia Blakeley, Date of Birth: 11/09/1980, Date joined the clinic: 2004, Address: 935 Massachusetts Avenue Hamilton 4562, Email: lucyblak@outlook.com, Phone: 38347463' > sbasicinfo.log
126
127     chmod -R 774 sbasicinfo.log
128
129     cd /opt/WellingtonClinic/staff/nurses/
130
131     userdel phmc2008
132     useradd phmc2008
133     sudo mkhomedir_helper phmc2008
134     usermod -a -G Nurses phmc2008
135
136     mkdir -p phmc2008
137         cd phmc2008
138         touch sbasicinfo.log
139         >sbasicinfo.log
140         echo -n > sbasicinfo.log
141         printf 'Phil McGraw, Date of Birth: 15/04/1984, Date joined the clinic: 2008, Address: 45 Razyn Street Petone Lower Hutt 8435, Email: philmcg@gmail.com, Phone: 02384756' > sbasicinfo.log
142
143     #set the correct permissions for sbasicinfo.log
144     chmod -R 774 sbasicinfo.log
145
```

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```
146  #change directory and make the receptionist users. Deletes them if they exist otherwise things stay the same.
147  cd /opt/WellingtonClinic/staff/receptionists/
148
149  echo "+++++++++++++++++++++++++"
150  echo "+                       +"
151  echo "+      Receptionists:    +"
152  echo "+ 1) Andy Smith          +"
153  echo "+                       +"
154  echo "+++++++++++++++++++++++++"
155
156  userdel ansm2002
157  useradd ansm2002
158  sudo mkhomedir_helper ansm2002
159  usermod -a -G Receptionists ansm2002
160
161  mkdir -p ansm2002
162      cd ansm2002
163      touch sbasicinfo.log
164      >sbasicinfo.log
165      echo -n > sbasicinfo.log
166      printf 'Andy Smith, Date of Birth: 13/09/1974, Date joined the clinic: 2002, Address: 58 Foster avenue Wellington 5011, Email: smith.andy74@gmail.com, Phone: 07284756' > sbasicinfo.log
167
168  # set the correct permissions for the sbasicinfo.log
169  chmod -R 774 sbasicinfo.log
170
171  #change directory and make the admin users. Deletes them if they exist otherwise things stay the same.
172  cd /opt/WellingtonClinic/staff/administrators/
173
174  echo "+++++++++++++++++++++++++++"
175  echo "+                         +"
176  echo "+     Administrators:     +"
177  echo "+ 1) Pauline Sanderson +"
178  echo "+                         +"
179  echo "+++++++++++++++++++++++++++"
180
181  userdel pasa1995
182  useradd pasa1995
183  sudo mkhomedir_helper pasa1995
184  usermod -a -G root pasa1995
185
186  mkdir -p pasa1995
187      cd pasa1995
188      touch sbasicinfo.log
189      >sbasicinfo.log
190      echo -n > sbasicinfo.log
191      printf 'Pauline Sanderson, Date-of-Birth: 08/03/1993, Date-joined-the-clinic: 1995, Address: 2452 Randolph Street Bedford Auckland 7752, Email: paulsand@admins.co.nz, Phone: 03747543' > sbasicinfo.log
192
193  #set the right permissions for the sbasicinfo.log file.
194  chmod -R 774 sbasicinfo.log
```

```
194    chmod -R 774 sbasicinfo.log
195
196    #change directory back to opt.
197    cd /opt/
198
```

Q4) (5 Marks) List the permissions and ACLs for all subjects/objects in the system. Explain the followings:

• Do these ACLs match the access matrix? List any deviations from the access matrix

```
# file: doctors//mate1997/sbasicinfo.log
# owner: root
# group: root
user::rwx
user:root:rwx
user:mate1997:r--
user:pasa1995:rwx
group::rwx
mask::rwx
other::r--
```

```
# file: doctors//brki2018/sbasicinfo.log
# owner: root
# group: root
user::rwx
user:root:rwx
user:brki2018:r--
user:pasa1995:rwx
group::rwx
mask::rwx
other::r--
```

```
# file: doctors//mada1993/sbasicinfo.log
# owner: root
# group: root
user::rwx
user:root:rwx
user:mada1993:r--
user:pasa1995:rwx
group::rwx
mask::rwx
other::r--
```

```
# file: doctors//labo2002/sbasicinfo.log
# owner: root
# group: root
user::rwx
user:root:rwx
user:labo2002:r--
user:pasa1995:rwx
group::rwx
mask::rwx
other::r--
```

Yes, my access matrix matches my acls. However, I only deviate when I give rw-permissions to the doctor which does not have any patients (that doctor being labo2002) to all patient's pmedicalrecord.log file.

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• Explain any design decisions you had to make and the reason behind it.

The way I have handled this part of the assignment is to hardcode most scripts to avoid any sort of obscure issues which might occur because of looping through information too many times or not enough. The file structure was made exactly how the UML diagram described the structure in the assignment handout. The only deviation was when I gave rw- permissions to the doctor labo2002 because he does not have any patients. I have done this to avoid the issue of when the patient will be shuffled to have an appointment with labo2002, labo has immediate access to their files. It is not ideal to do it this way because it defeats the purpose of the acl that only assigned doctors can check the patient's files. I also could not set the doctor to not have themselves as a patient (labo2002 is also a patient). I could have solved these issues with a forloop by checking the pmedicalinfo.log file for the doctor, but unfortunately due to time constraints for this assignment, I could not achieve this. Otherwise, everything functions as it should.

Q5) (10 Marks) Explain in detail where the ACL information of an object is saved on a Linux system and how your system keeps track of them.

The ACL information of an object is saved in the file's or directory's inode (index node) which stores metadata for the file. Depending on the ACL, they end up being stored in separate blocks.

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Q6) (20 Marks) Write a Bash/Python script (acls.sh) to assign access rights using ACLs according to the policy rules and your access matrix. The script must illustrate (include) creation of ACLs and setting proper permissions according to the use case.

```bash
1   #!/bin/bash
2
3   #This script is for Question 6.
4
5   #=================================================
6   #This part changes the permissions for the .log files
7   #=================================================
8   #Administrators/root
9
10  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/administrators/pasa1995/sbasicinfo.log
11  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/doctors/mate1997/sbasicinfo.log
12  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/doctors/mada1993/sbasicinfo.log
13  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/doctors/labo2002/sbasicinfo.log
14  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/doctors/brki2018/sbasicinfo.log
15  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/nurses/phmc2008/sbasicinfo.log
16  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/nurses/lubl2004/sbasicinfo.log
17  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff/receptionists/ansm2002/sbasicinfo.log
18
19  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
20  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
21  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
22  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
23  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
24  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
25  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
26  sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
27
28  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/administrators/pasa1995/sbasicinfo.log
29  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/doctors/mate1997/sbasicinfo.log
30  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/doctors/mada1993/sbasicinfo.log
31  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/doctors/labo2002/sbasicinfo.log
32  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/doctors/brki2018/sbasicinfo.log
33  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/nurses/phmc2008/sbasicinfo.log
34  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/nurses/lubl2004/sbasicinfo.log
35  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff/receptionists/ansm2002/sbasicinfo.log
36
37  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
38  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
39  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
40  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
41  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
42  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
43  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
44  sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
45
46  #++++++++++++++++++++++++++++++++++++++++++++++++++++
47  #Doctors
48
49  #Mary Teresa
```

```
49    #Mary Teresa
50    sudo setfacl -R -m u:mate1997:r-- /opt/WellingtonClinic/staff/doctors/mate1997/sbasicinfo.log
51
52    #only for the patient(s) assigned to this doctor
53    #Masood Mansoori
54
55    sudo setfacl -R -m u:mate1997:r-- /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
56    sudo setfacl -R -m u:mate1997:rw- /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
57
58    #Mandy Dannel
59
60    sudo setfacl -R -m u:mada1993:r-- /opt/WellingtonClinic/staff/doctors/mada1993/sbasicinfo.log
61
62    #only for the patient(s) assigned to this doctor
63    #David Travert
64    #Lance Bourne (patient, not the doctor)
65
66    sudo setfacl -R -m u:mada1993:r-- /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
67    sudo setfacl -R -m u:mada1993:rw- /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
68    sudo setfacl -R -m u:mada1993:r-- /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
69    sudo setfacl -R -m u:mada1993:rw- /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
70
71    #Lance Bourne
72
73    sudo setfacl -R -m u:labo2002:r-- /opt/WellingtonClinic/staff/doctors/labo2002/sbasicinfo.log
74
75    #only for the patient(s) assigned to this doctor
76
77    #I have done this because this doctor does not have any of these patients.
78    #Once these patients do end up with this doctor, this doctor will have access.
79
80    #Masood Mansoori
81    #David Travert
82    #Lance Bourne(patient, not the doctor)
83    #Peter Garcia
84
85    sudo setfacl -R -m u:labo2002:r-- /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
86    sudo setfacl -R -m u:labo2002:rw- /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
87    sudo setfacl -R -m u:labo2002:r-- /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
88    sudo setfacl -R -m u:labo2002:rw- /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
89    sudo setfacl -R -m u:labo2002:r-- /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
90    sudo setfacl -R -m u:labo2002:rw- /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
91    sudo setfacl -R -m u:labo2002:r-- /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
92    sudo setfacl -R -m u:labo2002:rw- /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
93
94    #Breana Kipling
95
96    sudo setfacl -R -m u:brki2018:r-- /opt/WellingtonClinic/staff/doctors/brki2018/sbasicinfo.log
97
```

```
 98   #only for the patient(s) assigned to this doctor
 99   #Peter Garcia
100   sudo setfacl -R -m u:brki2018:r-- /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
101   sudo setfacl -R -m u:brki2018:rw- /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
102
103   #+++++++++++++++++++++++++++++++++++++++++++++++++++++
104   #Nurses
105
106   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/staff/nurses/phmc2008/sbasicinfo.log
107   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
108   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
109   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
110   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
111   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
112   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
113   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
114   sudo setfacl -R -m u:phmc2008:r-- /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
115
116   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/staff/nurses/lubl2004/sbasicinfo.log
117   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
118   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
119   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
120   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
121   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
122   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
123   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
124   sudo setfacl -R -m u:lubl2004:r-- /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
125
126   #+++++++++++++++++++++++++++++++++++++++++++++++++++++
127   #Receptionists
128
129   sudo setfacl -R -m u:ansm2002:r-- /opt/WellingtonClinic/staff/receptionists/ansm2002/sbasicinfo.log
130   sudo setfacl -R -m u:ansm2002:rw- /opt/WellingtonClinic/patients/mi23122001/pbasicinfo.log
131   sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/patients/mi23122001/pmedicalrecord.log
132   sudo setfacl -R -m u:ansm2002:rw- /opt/WellingtonClinic/patients/dt08031993/pbasicinfo.log
133   sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/patients/dt08031993/pmedicalrecord.log
134   sudo setfacl -R -m u:ansm2002:rw- /opt/WellingtonClinic/patients/le07041970/pbasicinfo.log
135   sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/patients/le07041970/pmedicalrecord.log
136   sudo setfacl -R -m u:ansm2002:rw- /opt/WellingtonClinic/patients/pa13091976/pbasicinfo.log
137   sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/patients/pa13091976/pmedicalrecord.log
138
139   #=====================================================
140   #This part changes the permission for the .sh files.
141   #=====================================================
142   #Administrators/root
143
144   sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/file-system.sh
145   sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/staff-and-acls.sh
146   sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/acls.sh
```

```
147    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/patients.sh
148    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/visit.sh
149    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/searchpatient.sh
150    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts/audit.sh
151
152    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/file-system.sh
153    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/staff-and-acls.sh
154    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/acls.sh
155    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/patients.sh
156    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/visit.sh
157    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/searchpatient.sh
158    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts/audit.sh
159
160    #+++++++++++++++++++++++++++++++++++++++++++++++++++++
161    #Doctors
162
163    sudo setfacl -R -m u:mate1997:--- /opt/WellingtonClinic/scripts/file-system.sh
164    sudo setfacl -R -m u:mate1997:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
165    sudo setfacl -R -m u:mate1997:--- /opt/WellingtonClinic/scripts/acls.sh
166    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/scripts/patients.sh
167    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/scripts/visit.sh
168    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
169    sudo setfacl -R -m u:mate1997:--- /opt/WellingtonClinic/scripts/audit.sh
170
171    sudo setfacl -R -m u:mada1993:--- /opt/WellingtonClinic/scripts/file-system.sh
172    sudo setfacl -R -m u:mada1993:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
173    sudo setfacl -R -m u:mada1993:--- /opt/WellingtonClinic/scripts/acls.sh
174    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/scripts/patients.sh
175    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/scripts/visit.sh
176    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
177    sudo setfacl -R -m u:mada1993:--- /opt/WellingtonClinic/scripts/audit.sh
178
179    sudo setfacl -R -m u:labo2002:--- /opt/WellingtonClinic/scripts/file-system.sh
180    sudo setfacl -R -m u:labo2002:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
181    sudo setfacl -R -m u:labo2002:--- /opt/WellingtonClinic/scripts/acls.sh
182    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/scripts/patients.sh
183    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/scripts/visit.sh
184    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
185    sudo setfacl -R -m u:labo2002:--- /opt/WellingtonClinic/scripts/audit.sh
186
187    sudo setfacl -R -m u:brki2018:--- /opt/WellingtonClinic/scripts/file-system.sh
188    sudo setfacl -R -m u:brki2018:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
189    sudo setfacl -R -m u:brki2018:--- /opt/WellingtonClinic/scripts/acls.sh
190    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/scripts/patients.sh
191    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/scripts/visit.sh
192    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
193    sudo setfacl -R -m u:brki2018:--- /opt/WellingtonClinic/scripts/audit.sh
194
195    #+++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
196    #Nurses
197
198    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/file-system.sh
199    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
200    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/acls.sh
201    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/patients.sh
202    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/visit.sh
203    sudo setfacl -R -m u:phmc2008:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
204    sudo setfacl -R -m u:phmc2008:--- /opt/WellingtonClinic/scripts/audit.sh
205
206    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/file-system.sh
207    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
208    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/acls.sh
209    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/patients.sh
210    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/visit.sh
211    sudo setfacl -R -m u:lubl2004:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
212    sudo setfacl -R -m u:lubl2004:--- /opt/WellingtonClinic/scripts/audit.sh
213
214    #++++++++++++++++++++++++++++++++++++++++++++++++++++++++
215    #Receptionists
216
217    sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/scripts/file-system.sh
218    sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/scripts/staff-and-acls.sh
219    sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/scripts/acls.sh
220    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic/scripts/patients.sh
221    sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/scripts/visit.sh
222    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic/scripts/searchpatient.sh
223    sudo setfacl -R -m u:ansm2002:--- /opt/WellingtonClinic/scripts/audit.sh
224
225    #==========================================================
226    #This part changes the permission for the WellingtonClinic
227    #directory and its subdirectories.
228    #==========================================================
229    #Administrators/root
230
231    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic
232    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/staff
233    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/scripts
234    sudo setfacl -R -m u:root:rwx /opt/WellingtonClinic/patients
235
236    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic
237    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/staff
238    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/scripts
239    sudo setfacl -R -m u:pasa1995:rwx /opt/WellingtonClinic/patients
240
241    #Doctors
242
243    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic
244    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/staff
```

```
245    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/scripts
246    sudo setfacl -R -m u:mate1997:r-x /opt/WellingtonClinic/patients
247
248    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic
249    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/staff
250    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/scripts
251    sudo setfacl -R -m u:mada1993:r-x /opt/WellingtonClinic/patients
252
253    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic
254    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/staff
255    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/scripts
256    sudo setfacl -R -m u:labo2002:r-x /opt/WellingtonClinic/patients
257
258    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic
259    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/staff
260    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/scripts
261    sudo setfacl -R -m u:brki2018:r-x /opt/WellingtonClinic/patients
262
263    #Nurses
264
265    sudo setfacl -R -m u:phmc2008:r-x /opt/WellingtonClinic
266    sudo setfacl -R -m u:phmc2008:r-x /opt/WellingtonClinic/staff
267    sudo setfacl -R -m u:phmc2008:r-x /opt/WellingtonClinic/scripts
268    sudo setfacl -R -m u:phmc2008:r-x /opt/WellingtonClinic/patients
269
270    sudo setfacl -R -m u:lubl2004:r-x /opt/WellingtonClinic
271    sudo setfacl -R -m u:lubl2004:r-x /opt/WellingtonClinic/staff
272    sudo setfacl -R -m u:lubl2004:r-x /opt/WellingtonClinic/scripts
273    sudo setfacl -R -m u:lubl2004:r-x /opt/WellingtonClinic/patients
274
275    #Receptionists
276
277    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic
278    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic/staff
279    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic/scripts
280    sudo setfacl -R -m u:ansm2002:r-x /opt/WellingtonClinic/patients
```

Name: Abraham Alfred
Username: alfredabra
ID: 300509598

Q7) (10 Marks) Write a Bash/Python script (**patients.sh**) which lists the following three options corresponding to each task and allows the user to select and execute them.

- Register a new patient
- Make an appointment (task 8)
- Search for a patient (task 10)

Register a new patient by creating the necessary folders and files. Only the receptionists (and root) must be able to execute the script. The script asks the receptionist to enter all the patient's basic personal information:

"Enter the following information about the patient:"
- *First name:*
- *Surname:*
- *Date of birth (23/12/2001):*
- *Gender:*
- *Physical address:*
- *Email:*
- *Phone number:*
- *Registered doctor:*

And the patients are as following:

Patients:
1. *Masood,Mansoori,23/12/2001,male,130 Aro Street,masood.mansoori@mail.com,08965193,mate1997*
2. *David,Travert,08/03/1993,male,42 AZX ave. Thorndon Wellington,dtrt@gmail.com,04838372,mada1993*
3. *Peter,Garcia,13/09/1976,male,3 Kano street Kelburn Wellington,peterg@outlook.com,0575938,brki2018*
4. *Lance,Bourne,07/04/1970,male, 25 Ferguson Street Franklin Greytown 8567, lancb@outlook.com,083736456,mada1993*

```bash
#!/bin/bash
#This script is for Question 7 and 8

# Question 7

echo ""
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+ This is the patient manager for the Wellington Clinic. +"
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo ""
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+                                                           +"
echo "+    Select an input from 1, 2 or 3:                        +"
echo "+        [1] Set up the new patient.                        +"
echo "+        [2] See which doctor the patient is booked with.   +"
echo "+        [3] Search for a patient.                          +"
echo "+                                                           +"
echo "+    NOTE: Receptionists, if you encounter any problems,    +"
echo "+              call the administrator on (024523546).       +"
echo "+                                                           +"
echo "+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"

#Start reading the input
read input
    #If the input is 1, start asking information about the patient
    if [ $input -eq 1 ]

    then
        echo "Enter the following information about the patient:"
        read -p "First Name: " fName
        read -p "Surname: " sName
        read -p "Date of Birth: " dBirth
        read -p "Gender: " gen
        read -p "Physical address: " pAdd
        read -p "Email: " eMl
        read -p "Phone number: " phNum
        read -p "Registered doctor: " regDoc

        echo $fName
        echo $sName
        echo $dBirth
        echo $gen
        echo $pAdd
        echo $eMl
        echo $phNum
        echo $regDoc

        #change directories to go inside patients
        cd /opt/WellingtonClinic/patients/
```

Name: Abraham Alfred
Username: alfredabra
ID: 300509598

```
49          cd /opt/WellingtonClinic/patients/
50
51
52          #make the first letter read the first lowercase string of the file, and last letter reads the last
53          #string of the file. Also makes sure it concatonates through the "/" in dob input
54          fLetter=${fName:0:1}
55          lLetter=${sName: -1}
56          dOB=${dBirth//\/}
57
58          #read all inputs as variable filename, make directory called the patients firstletter, lastletter and dob
59          #change directory to that filename.
60          fileName="$fLetter$lLetter$dOB"
61          mkdir -p $fileName
62          cd $fileName
63
64          #echo the information from the inputs to pbasicinfo.log
65          echo "$fName", "$sName", "$dBirth", "$gen", "$pAdd", "$eMl", "$phNum", "$regDoc" > pbasicinfo.log
66
67          #Change directory and run a forloop to save the filename as lowercase to follow the assignment
68          # script.
69          cd /opt/WellingtonClinic/patients
70          for name in ${fileName}; do
71                  #set new name in lower case for files and directories
72                  new_name="$(dirname "${fileName}")/$(basename "${fileName}" | tr '[A-Z]' '[a-z]')"
73
74                  #check if new name already exists
75                  if [ "${name}" != "${new_name}" ]; then
76                      [ ! -e "${new_name}" ] && mv -T "${name}" "${new_name}"; echo "${name} was renamed to ${new_name}" || echo "${name} wasn't renamed!"
77              fi #exit forloop
78      done #once done, leave.
```

Q8) (10 Marks) Write a Bash/Python script (**patients.sh**) to make an appointment for a patient. The script asks for patient's firstname, surname and date of birth. It then retrieves and lists the date and name of all doctors visited in previous bookings by the patient. "If" a new doctor is scheduled to see the patient, proper access rights on patient files (and directories) must be granted to the new doctor.

```
79
80          #If the input is 2, run code for Question 8. This will gather information about the patient
81          # and tell the receptionist who the doctor assigned for this patient is.
82          elif [ $input -eq 2 ]
83          then
84
85          # Question 8. Read the firstname as lowercase, helps avoid issues with Capital inputs.
86          echo "To book an appointment, enter the following information about the patient:"
87          read -p "First Name: " fName
88          fName=${fName,,}
89          read -p "Surname: " sName
90          read -p "Date of Birth: " dBirth
91
92          echo $fName
93          echo $sName
94          echo $dBirth
95
96          #change directory to patients
97          cd /opt/WellingtonClinic/patients/
98
99          #do similar stuff from question 7.
100         fLetter=${fName:0:1}
101         lLetter=${sName: -1}
102         dOB=${dBirth//\/}
103
104         fileName="$fLetter$lLetter$dOB"
105         echo "$fileName"
106         cd "$fileName"
107
108         #change directory into that file. Make a file called pmedicalrecord.log
109         cd /opt/WellingtonClinic/patients/${fileName}/
110         touch pmedicalrecord.log
111
112         #make a variable for the log file.
113         f1="pmedicalrecord.log"
114             # read the line of the file and run a delimiter to get the Date and the Doctor out of the file.
115             while IFS= read -r l1
116             do
117             IFS=','
118             read -a delim <<< "$l1"
119             echo "Date: ${delim[0]} | Doctor: ${delim[1]}"
120             done < "$f1"
121
122             #do same as above but read through the first line from pbasicinfo instead and pass it to an array.
123             f2="pbasicinfo.log"
124             while IFS= read -r l2
125             do
126             readarray -d, -t strarr <<<"l2"
127             done < "$f2"
```

```
128
129             #make a variable for storing the array, then filter the right information from the file.
130             # then change the directory to patients and set the acl permissions for the doctor to rw
131             # for the pmedicalrecord.log.
132             doc="${strarr[7]}"
133             doc=`echo $doc | sed 's/ *$//g'`
134             cd /opt/WellingtonClinic/patients/
135             setfacl -R -m u:$doc:rw /opt/WellingtonClinic/patients/${fileName}/pmedicalrecord.log
```

Q9) (5 Marks) Write a Bash/Python script (visit.sh) to add information about a patient's visit. This information is added by the patient's doctor (pmedicalrecord.log).

```bash
1   #!/bin/bash
2
3   #This code is for Question 9
4
5   echo ""
6   echo "+++++++++++++++++++++++++++++"
7   echo ""
8   echo "This script lets you write information about the patient."
9   echo ""
10  echo "NOTE: Doctors, if you encounter any problems,"
11  echo "      call the administrator on (024523546). "
12  echo ""
13  echo "+++++++++++++++++++++++++++++"
14
15  #This file basically tells the doctor to input the patients information. Once entered, it saves
16  # it in the correct format for the pmedicalrecord.log file to be read later.
17 ▼ echo "Enter the following information about the patient:"
18      read -p "First Name: " fName
19      fName=${fName,,}
20      read -p "Surname: " sName
21      read -p "Date of Birth: " dBirth
22
23      cd /opt/WellingtonClinic/patients/
24
25      echo $fName
26      echo $sName
27      echo $dBirth
28
29      fLetter=${fName:0:1}
30      lLetter=${sName: -1}
31      dOB=${dBirth///}
32
33      fileName="$fLetter$lLetter$dOB"
34      echo "$fileName"
35      cd $fileName
36      f="pmedicalrecord.log"
37
38      read -r -p "Date of visit: " dVisit
39      read -r -p "Doctor assigned: " doc
40      read -r -p "Issue: " i
41      read -r -p "Medicine prescribed: " med
42      read -r -p "Required dosage: " d
43
44  echo -e "$dVisit","$doc","$i","$med","$d" >> $f
```

Name: Abraham Alfred
Username: alfredabra
ID: 300509598

Q10) (10 Marks) Write a script (**searchpatient.sh**) to ask for a doctor's username and search and list all the patients ever examined by a particular doctor. The script can also ask for a patient's first name, last name and date of birth and list all the doctors who have examined the patient. This script can be executed by all staff (not all users of the system but the clinic staff only).

```bash
1   #!/bin/bash
2   # This script is for Question 10
3   echo ""
4   echo "++++++++++++++++++++++++++++++"
5   echo "+                            +"
6   echo "+     Patient Search.        +"
7   echo "+                            +"
8   echo "++++++++++++++++++++++++++++++"
9   echo ""
10
11  echo ""
12      #start asking the receptionist for the patients details. Some code reused from 7 and 8.
13      read -p "Doctor's Username: " dName
14      dName=${dName,,}
15
16      read -p "First Name: " fName
17      fName=${fName,,}
18      read -p "Surname: " sName
19      read -p "Date of Birth: " dBirth
20
21      echo $fName
22      echo $sName
23      echo $dBirth
24
25      fLetter=${fName:0:1}
26      lLetter=${sName: -1}
27      dOB=${dBirth///}
28
29      fileName="$fLetter$lLetter$dOB"
30      echo "$fileName"
31
32  echo ""
33  echo "++++++++++++++++++++++++++++++"
34  echo "+                            +"
35  echo "+ Pick either from 1 or 2 +"
36  echo "+  [1] Pick from patient. +"
37  echo "+  [2] Pick from doctor.  +"
38  echo "+                            +"
39  echo "++++++++++++++++++++++++++++++"
40  echo ""
41      #Start reading the input given.
42      read input
43
44          #if its 1, then make an array and change directory to the given filename. Similar delimiter
45          # used from question 8.
46          if [ $input -eq 1 ]
47          then
48          declare -a readArr
49          cd /opt/WellingtonClinic/patients/${fileName}/
```

```bash
50              while IFS= read -r l1
51              do
52              IFS=','
53              read -a delim <<< "$l1"
54              readArr+=${delim[1]}
55          done < pmedicalrecord.log
56      #read through the array and truncate any empty spaces and quotation marks and sort through.
57      echo "Doctor: ${readArr[@]}" | tr ' ' '\n' | sort -u | tr '\n' ' '
58
59      #if the input is 2, then change directory to patients, run a forloop through a wildcard directory
60      # to get the doctor from the file, if  the doctor matches, print the doctor. Then break then finish.
61      elif [ $input -eq 2 ]
62      then
63
64      cd /opt/WellingtonClinic/patients
65      for doc in */; do
66          while IFS= read -r l2
67              do
68              IFS=','
69              read -a delim <<< "$l2"
70                  if [[ "${delim[1]}" == *"$dName"* ]]
71                      then
72                      echo $doc
73                  break
74          fi
75      done < $doc/pmedicalrecord.log
76  done
77      #Let the receptionist know that the input is valid. then finish.
78      else
79          echo "This is not a valid option. Please try again."
80      fi
```

Name: Abraham Alfred
Username: alfredabra
ID: 300509598

Q11) (10 Marks) A script file (**audit.sh**) which displays information on any changes in permission, object creation, deletion and modification on the WellingtonClinic directory, its subdirectories and files. The audit script should display the username performing the operation, the type of the operation and the object on which the operation takes place. This file is only run by the administrator(s).

```bash
#!/bin/bash

#This is the script for Question 11

echo ""
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+ This is the auditing script for the Wellington Clinic. +"
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo ""
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"
echo "+                                                            +"
echo "+    Select an input from 1, 2, 3 or 4:                      +"
echo "+        [1] Start the audit.                                +"
echo "+        [2] Stop the audit.                                 +"
echo "+        [3] See the result of the audit.                    +"
echo "+        [4] Restart the audit.                              +"
echo "+                                                            +"
echo "++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++"

#Start reading the input
read input

    #Runs the auditd and sets the right permissions for auditctl.
    if [ $input -eq 1 ]
        then
            sudo service auditd start
                sudo auditctl -w /opt/WellingtonClinic -p wa -k log_WellingtonClinic
    #Stops the service once the user reruns this script and presses 2.
    elif [ $input -eq 2 ]
        then
            sudo service auditd stop
    #Gives a report to the user of what log information was captured.
    elif [ $input -eq 3 ]
            then
                    sudo aureport -i -k
    #Restarts the service if the user wants to rerun it.
    elif [ $input -eq 4 ]
        then
            sudo service auditd restart
    #Tells the user that the input is wrong.
    else
        echo "This is an invalid imput. Please try again."
    #Once done, exit.
    fi
```