

# DSBDAL-9

April 1, 2024

## #Data Visualization II

1. Use the inbuilt dataset 'titanic' as used in the above problem. Plot a box plot for distribution of age with respect to each gender along with the information about whether they survived or not. (Column names : 'sex' and 'age')
2. Write observations on the inference from the above statistics.

```
[1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Loading the dataset, checking for null values and preprocessing data

```
[3]: df = sns.load_dataset('titanic')
df
```

```
[3]:   survived  pclass    sex  age  sibsp  parch    fare embarked  class \
0         0      3  male  22.0     1     0   7.2500         S  Third
1         1      1 female  38.0     1     0  71.2833         C  First
2         1      3 female  26.0     0     0   7.9250         S  Third
3         1      1 female  35.0     1     0  53.1000         S  First
4         0      3  male  35.0     0     0   8.0500         S  Third
..      ...      ...      ...      ...      ...      ...      ...
886        0      2  male  27.0     0     0  13.0000         S  Second
887        1      1 female  19.0     0     0  30.0000         S  First
888        0      3 female   NaN     1     2  23.4500         S  Third
889        1      1  male  26.0     0     0  30.0000         C  First
890        0      3  male  32.0     0     0   7.7500         Q  Third
```

```
   who  adult_male  deck  embark_town  alive  alone
0   man         True  NaN  Southampton    no  False
1  woman        False   C   Cherbourg   yes  False
2  woman        False  NaN  Southampton   yes   True
3  woman        False   C   Southampton   yes  False
4   man         True  NaN  Southampton    no   True
..   ...      ...      ...      ...      ...
886  man         True  NaN  Southampton    no   True
887  woman        False   B   Southampton   yes   True
```

888	woman	False	NaN	Southampton	no	False
889	man	True	C	Cherbourg	yes	True
890	man	True	NaN	Queenstown	no	True

[891 rows x 15 columns]

```
[4]: df.shape
```

```
[4]: (891, 15)
```

```
[7]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 15 columns):
#   Column          Non-Null Count  Dtype
---  -
0   survived        891 non-null    int64
1   pclass          891 non-null    int64
2   sex             891 non-null    object
3   age            714 non-null    float64
4   sibsp          891 non-null    int64
5   parch          891 non-null    int64
6   fare           891 non-null    float64
7   embarked        889 non-null    object
8   class           891 non-null    category
9   who             891 non-null    object
10  adult_male      891 non-null    bool
11  deck            203 non-null    category
12  embark_town     889 non-null    object
13  alive           891 non-null    object
14  alone           891 non-null    bool
dtypes: bool(2), category(2), float64(2), int64(4), object(5)
memory usage: 80.7+ KB
```

```
[6]: df.head()
```

```
[6]:   survived  pclass   sex  age  sibsp  parch   fare embarked  class \
0         0      3  male  22.0     1     0   7.2500          S  Third
1         1      1 female  38.0     1     0  71.2833          C  First
2         1      3 female  26.0     0     0   7.9250          S  Third
3         1      1 female  35.0     1     0  53.1000          S  First
4         0      3  male  35.0     0     0   8.0500          S  Third

      who  adult_male  deck  embark_town  alive  alone
0   man      True   NaN  Southampton    no  False
1 woman     False    C   Cherbourg   yes  False
```

2	woman	False	NaN	Southampton	yes	True
3	woman	False	C	Southampton	yes	False
4	man	True	NaN	Southampton	no	True

```
[8]: df.describe()
```

```
[8]:
```

	survived	pclass	age	sibsp	parch	fare
count	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

```
[9]: df.describe(include = 'object')
```

```
[9]:
```

	sex	embarked	who	embark_town	alive
count	891	889	891	889	891
unique	2	3	3	3	2
top	male	S	man	Southampton	no
freq	577	644	537	644	549

```
[10]: df.tail()
```

```
[10]:
```

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class \
886	0	2	male	27.0	0	0	13.00	S	Second
887	1	1	female	19.0	0	0	30.00	S	First
888	0	3	female	NaN	1	2	23.45	S	Third
889	1	1	male	26.0	0	0	30.00	C	First
890	0	3	male	32.0	0	0	7.75	Q	Third

	who	adult_male	deck	embark_town	alive	alone
886	man	True	NaN	Southampton	no	True
887	woman	False	B	Southampton	yes	True
888	woman	False	NaN	Southampton	no	False
889	man	True	C	Cherbourg	yes	True
890	man	True	NaN	Queenstown	no	True

```
[12]: df.isnull().sum()
```

```
[12]:
```

survived	0
pclass	0
sex	0
age	177
sibsp	0

```

parch      0
fare       0
embarked    2
class      0
who         0
adult_male  0
deck       688
embark_town 2
alive       0
alone       0
dtype: int64

```

Filling up the NULL values in the dataset.

```
[13]: df['age'] = df['age'].fillna(np.mean(df['age']))
```

```
[14]: df['deck'] = df['deck'].fillna(df['deck'].mode()[0])
```

```
[15]: df['embark_town'] = df['embark_town'].fillna(df['embark_town'].mode()[0])
```

```
[16]: df['embarked'] = df['embarked'].fillna(df['embarked'].mode()[0])
```

```
[17]: df.isnull().sum()
```

```

[17]: survived      0
pclass             0
sex                0
age                0
sibsp             0
parch             0
fare              0
embarked           0
class             0
who               0
adult_male        0
deck              0
embark_town       0
alive             0
alone             0
dtype: int64

```

```
[18]: df.head()
```

```

[18]:  survived  pclass    sex  age  sibsp  parch   fare  embarked  class  \
0         0      3   male  22.0    1     0   7.2500         S   Third
1         1      1  female  38.0    1     0  71.2833         C   First
2         1      3  female  26.0    0     0   7.9250         S   Third

```

3	1	1	female	35.0	1	0	53.1000	S	First
4	0	3	male	35.0	0	0	8.0500	S	Third

	who	adult_male	deck	embark_town	alive	alone
0	man	True	C	Southampton	no	False
1	woman	False	C	Cherbourg	yes	False
2	woman	False	C	Southampton	yes	True
3	woman	False	C	Southampton	yes	False
4	man	True	C	Southampton	no	True

```
[19]: df.tail()
```

```
[19]:      survived  pclass    sex      age  sibsp  parch   fare embarked \
886          0        2   male  27.000000      0      0   13.00         S
887          1        1  female  19.000000      0      0   30.00         S
888          0        3  female  29.699118      1      2   23.45         S
889          1        1   male  26.000000      0      0   30.00         C
890          0        3   male  32.000000      0      0    7.75         Q
```

	class	who	adult_male	deck	embark_town	alive	alone
886	Second	man	True	C	Southampton	no	True
887	First	woman	False	B	Southampton	yes	True
888	Third	woman	False	C	Southampton	no	False
889	First	man	True	C	Cherbourg	yes	True
890	Third	man	True	C	Queenstown	no	True

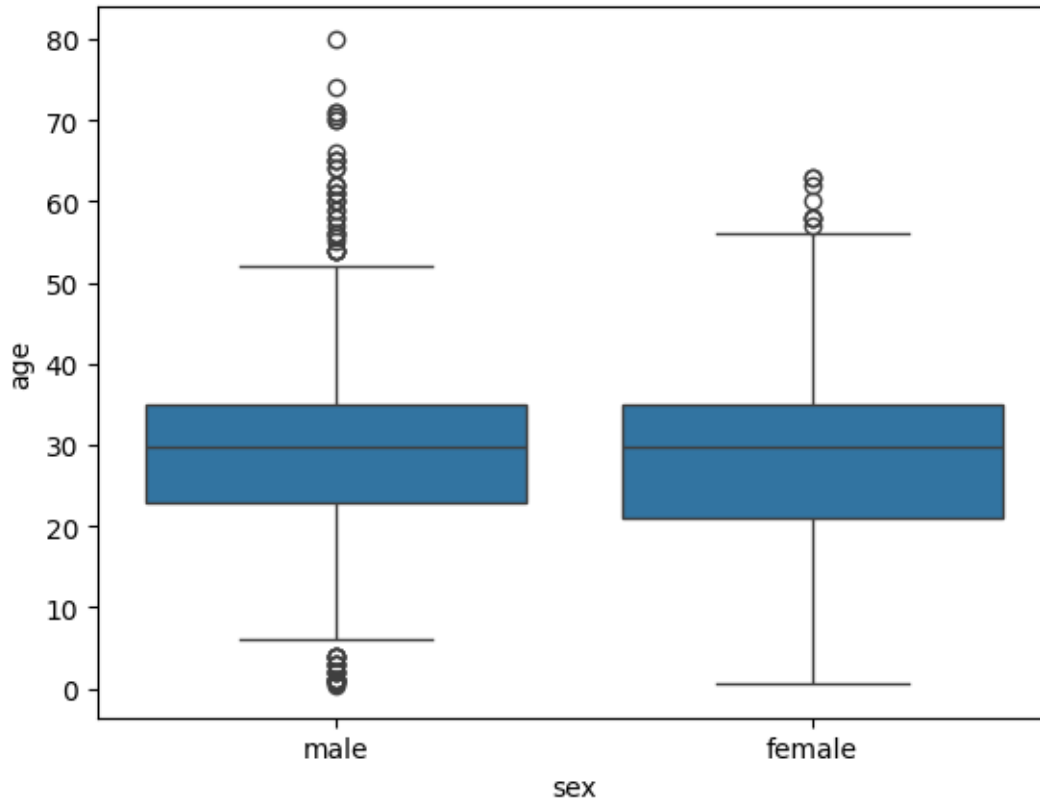
I. A box plot for distribution of age with respect to each gender

The **box plot** is used to display the distribution of the categorical data in the form of quartiles. The centre of the box shows the median value. The value from the lower whisker to the bottom of the box shows the first quartile. From the bottom of the box to the middle of the box lies the second quartile. From the middle of the box to the top of the box lies the third quartile and finally from the top of the box to the top whisker lies the last quartile.

pass the categorical column as the first parameter (which is sex in our case) and the numeric column (age in our case) as the second parameter. Finally, the dataset is passed as the third parameter.

```
[23]: sns.boxplot (x = 'sex', y = 'age', data = df)
```

```
[23]: <Axes: xlabel='sex', ylabel='age'>
```



### Observations:

---

box plot for *females*:

The first quartile starts at around 1 and ends at 20 which means that 25% of the passengers are aged between 1 and 20. The second quartile starts at around 20 and ends at around 28 which means that 25% of the passengers are aged between 20 and 28. Similarly, the third quartile starts and ends between 28 and 38, hence 25% passengers are aged within this range and finally the fourth or last quartile starts at 38 and ends around 64.

box plot for *males*:

The first quartile starts at around 5 and ends at 22. The second quartile starts at around 22 and ends at around 28 which means that 25% of the passengers are aged between 22 and 28. Similarly, the third quartile starts and ends between 28 and 38, hence 25% passengers are aged within this range and finally the fourth or last quartile starts at 38 and ends around 64.

If there are any outliers or the passengers that do not belong to any of the quartiles, they are called outliers and are represented by dots on the box plot.

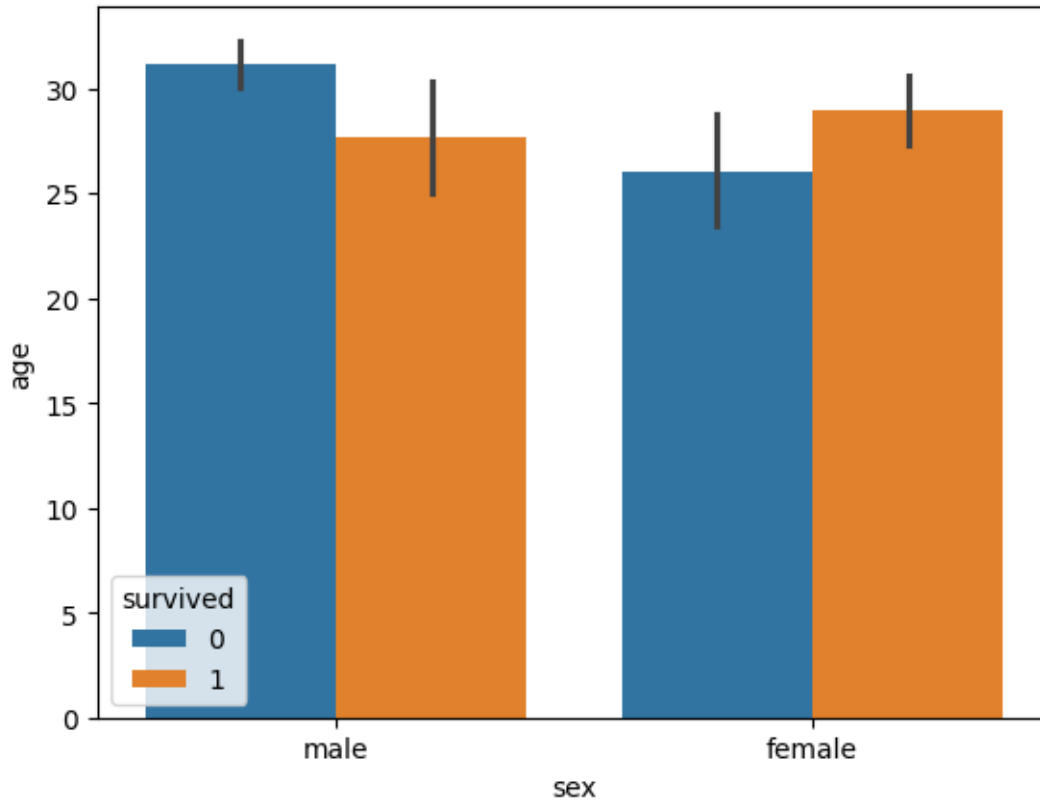
---

II. A box plot for distribution of age with respect to each gender along with the information

about whether they survived or not. (Column names : 'sex' and 'age')

```
[25]: sns.barplot (x = 'sex', y = 'age', data = df, hue = 'survived')
```

```
[25]: <Axes: xlabel='sex', ylabel='age'>
```



#### Observations:

among the *male* passengers, on average more younger people survived as compared to the older ones. the variation among the age of *female* passengers who did not survive is much greater than the age of the surviving female passengers.

```
[26]: !apt-get install texlive texlive-xetex texlive-latex-extra pandoc  
      !pip install pypandoc
```

```
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
pandoc is already the newest version (2.9.2.1-3ubuntu2).  
pandoc set to manually installed.  
The following additional packages will be installed:
```

```

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-
texgyre
  fonts-urw-base35 libapache-pom-java libcommons-logging-java libcommons-parent-
java
  libfontbox-java libfontenc1 libgs9 libgs9-common libidn12 libijs-0.35
libjbig2dec0 libkpathsea6
  libpdfbox-java libptexenc1 libruby3.0 libsynchronet2 libteckit0 libtexlua53
libtexluajit2 libwoff1
  libzip-0-13 lmodern poppler-data preview-latex-style rake ruby ruby-net-
telnet ruby-rubygems
  ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-
common tex-gyre
  texlive-base texlive-binaries texlive-fonts-recommended texlive-latex-base
  texlive-latex-recommended texlive-pictures texlive-plain-generic tipa xfonts-
encodings
  xfonts-utils
Suggested packages:
  fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java
  libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java poppler-
utils ghostscript
  fonts-japanese-mincho | fonts-ipafont-mincho fonts-japanese-gothic | fonts-
ipafont-gothic
  fonts-arphic-ukai fonts-arphic-uming fonts-nanum ri ruby-dev bundler debhelper
gv
  | postscript-viewer perl-tk xpdf | pdf-viewer xzdec texlive-fonts-recommended-
doc
  texlive-latex-base-doc python3-pygments icc-profiles libfile-which-perl
  libspreadsheet-parseexcel-perl texlive-latex-extra-doc texlive-latex-
recommended-doc
  texlive-luatex texlive-pstricks dot2tex prerex texlive-pictures-doc vprerex
default-jre-headless
  tipa-doc
The following NEW packages will be installed:
  dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-
texgyre
  fonts-urw-base35 libapache-pom-java libcommons-logging-java libcommons-parent-
java
  libfontbox-java libfontenc1 libgs9 libgs9-common libidn12 libijs-0.35
libjbig2dec0 libkpathsea6
  libpdfbox-java libptexenc1 libruby3.0 libsynchronet2 libteckit0 libtexlua53
libtexluajit2 libwoff1
  libzip-0-13 lmodern poppler-data preview-latex-style rake ruby ruby-net-
telnet ruby-rubygems
  ruby-webrick ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-
common tex-gyre texlive
  texlive-base texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-extra
  texlive-latex-recommended texlive-pictures texlive-plain-generic texlive-xetex

```



tipa

xfonts-encodings xfonts-utils

0 upgraded, 55 newly installed, 0 to remove and 45 not upgraded.

Need to get 182 MB of archives.

After this operation, 572 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-droid-fallback all 1:6.0.1r16-1.1build1 [1,805 kB]

Get:2 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-lato all 2.0-2.1 [2,696 kB]

Get:3 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 poppler-data all 0.4.11-1 [2,171 kB]

Get:4 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-common all 6.17 [33.7 kB]

Get:5 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-urw-base35 all 20200910-1 [6,367 kB]

Get:6 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9-common all 9.55.0~dfsg1-0ubuntu5.6 [751 kB]

Get:7 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libidn12 amd64 1.38-4ubuntu1 [60.0 kB]

Get:8 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libijs-0.35 amd64 0.35-15build2 [16.5 kB]

Get:9 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libjbig2dec0 amd64 0.19-3build2 [64.7 kB]

Get:10 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9 amd64 9.55.0~dfsg1-0ubuntu5.6 [5,031 kB]

Get:11 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libkpathsea6 amd64 2021.20210626.59705-1ubuntu0.2 [60.4 kB]

Get:12 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libwoff1 amd64 1.0.2-1build4 [45.2 kB]

Get:13 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 dvisvgm amd64 2.13.1-1 [1,221 kB]

Get:14 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-lmodern all 2.004.5-6.1 [4,532 kB]

Get:15 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-noto-mono all 20201225-1build1 [397 kB]

Get:16 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-texgyre all 20180621-3.1 [10.2 MB]

Get:17 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libapache-pom-java all 18-1 [4,720 B]

Get:18 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-parent-java all 43-1 [10.8 kB]

Get:19 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-logging-java all 1.2-2 [60.3 kB]

Get:20 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libfontenc1 amd64 1:1.1.4-1build3 [14.7 kB]

Get:21 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libptexenc1 amd64 2021.20210626.59705-1ubuntu0.2 [39.1 kB]

Get:22 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rubygems-integration

all 1.18 [5,336 B]  
 Get:23 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby3.0 amd64 3.0.2-7ubuntu2.4 [50.1 kB]  
 Get:24 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby-rubygems all 3.3.5-2 [228 kB]  
 Get:25 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby amd64 1:3.0~exp1 [5,100 B]  
 Get:26 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rake all 13.0.6-2 [61.7 kB]  
 Get:27 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby-net-telnet all 0.1.1-2 [12.6 kB]  
 Get:28 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 ruby-webrick all 1.7.0-3 [51.8 kB]  
 Get:29 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby-xmlrpc all 0.3.2-1ubuntu0.1 [24.9 kB]  
 Get:30 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libruby3.0 amd64 3.0.2-7ubuntu2.4 [5,113 kB]  
 Get:31 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libsyntax2 amd64 2021.20210626.59705-1ubuntu0.2 [55.6 kB]  
 Get:32 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libteckit0 amd64 2.5.11+ds1-1 [421 kB]  
 Get:33 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexlua53 amd64 2021.20210626.59705-1ubuntu0.2 [120 kB]  
 Get:34 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexluajit2 amd64 2021.20210626.59705-1ubuntu0.2 [267 kB]  
 Get:35 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libzip-0-13 amd64 0.13.72+dfsg.1-1.1 [27.0 kB]  
 Get:36 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-encodings all 1:1.0.5-0ubuntu2 [578 kB]  
 Get:37 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-utils amd64 1:7.7+6build2 [94.6 kB]  
 Get:38 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 lmodern all 2.004.5-6.1 [9,471 kB]  
 Get:39 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 preview-latex-style all 12.2-1ubuntu1 [185 kB]  
 Get:40 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 tiutils amd64 1.41-4build2 [61.3 kB]  
 Get:41 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 teckit amd64 2.5.11+ds1-1 [699 kB]  
 Get:42 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-gyre all 20180621-3.1 [6,209 kB]  
 Get:43 <http://archive.ubuntu.com/ubuntu> jammy-updates/universe amd64 texlive-binaries amd64 2021.20210626.59705-1ubuntu0.2 [9,860 kB]  
 Get:44 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-base all 2021.20220204-1 [21.0 MB]  
 Get:45 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-fonts-recommended all 2021.20220204-1 [4,972 kB]  
 Get:46 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-latex-base

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all 2021.20220204-1 [1,128 kB]
Get:47 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-
recommended all 2021.20220204-1 [14.4 MB]
Get:48 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive all
2021.20220204-1 [14.3 kB]
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1:1.8.16-2 [207 kB]
Get:50 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:51 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
Get:52 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-extra
all 2021.20220204-1 [13.9 MB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:54 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:55 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
Fetched 182 MB in 26s (7,067 kB/s)
Extracting templates from packages: 100%
Preconfiguring packages ...
Selecting previously unselected package fonts-droid-fallback.
(Reading database ... 121753 files and directories currently installed.)
Preparing to unpack .../00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
...
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Selecting previously unselected package fonts-lato.
Preparing to unpack .../01-fonts-lato_2.0-2.1_all.deb ...
Unpacking fonts-lato (2.0-2.1) ...
Selecting previously unselected package poppler-data.
Preparing to unpack .../02-poppler-data_0.4.11-1_all.deb ...
Unpacking poppler-data (0.4.11-1) ...
Selecting previously unselected package tex-common.
Preparing to unpack .../03-tex-common_6.17_all.deb ...
Unpacking tex-common (6.17) ...
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack .../04-fonts-urw-base35_20200910-1_all.deb ...
Unpacking fonts-urw-base35 (20200910-1) ...
Selecting previously unselected package libgs9-common.
Preparing to unpack .../05-libgs9-common_9.55.0~dfsg1-0ubuntu5.6_all.deb ...
Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.6) ...
Selecting previously unselected package libidn12:amd64.
Preparing to unpack .../06-libidn12_1.38-4ubuntu1_amd64.deb ...
Unpacking libidn12:amd64 (1.38-4ubuntu1) ...
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack .../07-libijs-0.35_0.35-15build2_amd64.deb ...
Unpacking libijs-0.35:amd64 (0.35-15build2) ...

```

```

Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack .../08-libjbig2dec0_0.19-3build2_amd64.deb ...
Unpacking libjbig2dec0:amd64 (0.19-3build2) ...
Selecting previously unselected package libgs9:amd64.
Preparing to unpack .../09-libgs9_9.55.0~dfsg1-0ubuntu5.6_amd64.deb ...
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.6) ...
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack .../10-libkpathsea6_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack .../11-libwoff1_1.0.2-1build4_amd64.deb ...
Unpacking libwoff1:amd64 (1.0.2-1build4) ...
Selecting previously unselected package dvisvgm.
Preparing to unpack .../12-dvisvgm_2.13.1-1_amd64.deb ...
Unpacking dvisvgm (2.13.1-1) ...
Selecting previously unselected package fonts-lmodern.
Preparing to unpack .../13-fonts-lmodern_2.004.5-6.1_all.deb ...
Unpacking fonts-lmodern (2.004.5-6.1) ...
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack .../14-fonts-noto-mono_20201225-1build1_all.deb ...
Unpacking fonts-noto-mono (20201225-1build1) ...
Selecting previously unselected package fonts-texgyre.
Preparing to unpack .../15-fonts-texgyre_20180621-3.1_all.deb ...
Unpacking fonts-texgyre (20180621-3.1) ...
Selecting previously unselected package libapache-pom-java.
Preparing to unpack .../16-libapache-pom-java_18-1_all.deb ...
Unpacking libapache-pom-java (18-1) ...
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack .../17-libcommons-parent-java_43-1_all.deb ...
Unpacking libcommons-parent-java (43-1) ...
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack .../18-libcommons-logging-java_1.2-2_all.deb ...
Unpacking libcommons-logging-java (1.2-2) ...
Selecting previously unselected package libfontenc1:amd64.
Preparing to unpack .../19-libfontenc1_1%3a1.1.4-1build3_amd64.deb ...
Unpacking libfontenc1:amd64 (1:1.1.4-1build3) ...
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack .../20-libptexenc1_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package rubygems-integration.
Preparing to unpack .../21-rubygems-integration_1.18_all.deb ...
Unpacking rubygems-integration (1.18) ...
Selecting previously unselected package ruby3.0.
Preparing to unpack .../22-ruby3.0_3.0.2-7ubuntu2.4_amd64.deb ...
Unpacking ruby3.0 (3.0.2-7ubuntu2.4) ...
Selecting previously unselected package ruby-rubygems.

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Preparing to unpack .../23-ruby-rubygems_3.3.5-2_all.deb ...
Unpacking ruby-rubygems (3.3.5-2) ...
Selecting previously unselected package ruby.
Preparing to unpack .../24-ruby_1%3a3.0~exp1_amd64.deb ...
Unpacking ruby (1:3.0~exp1) ...
Selecting previously unselected package rake.
Preparing to unpack .../25-rake_13.0.6-2_all.deb ...
Unpacking rake (13.0.6-2) ...
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack .../26-ruby-net-telnet_0.1.1-2_all.deb ...
Unpacking ruby-net-telnet (0.1.1-2) ...
Selecting previously unselected package ruby-webrick.
Preparing to unpack .../27-ruby-webrick_1.7.0-3_all.deb ...
Unpacking ruby-webrick (1.7.0-3) ...
Selecting previously unselected package ruby-xmldr.
Preparing to unpack .../28-ruby-xmldr_0.3.2-1ubuntu0.1_all.deb ...
Unpacking ruby-xmldr (0.3.2-1ubuntu0.1) ...
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack .../29-libruby3.0_3.0.2-7ubuntu2.4_amd64.deb ...
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.4) ...
Selecting previously unselected package libsynchronizer2:amd64.
Preparing to unpack .../30-libsynchronizer2_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libsynchronizer2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack .../31-libteckit0_2.5.11+ds1-1_amd64.deb ...
Unpacking libteckit0:amd64 (2.5.11+ds1-1) ...
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack .../32-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libtexluaajit2:amd64.
Preparing to unpack
.../33-libtexluaajit2_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking libtexluaajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libzip-0-13:amd64.
Preparing to unpack .../34-libzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb ...
Unpacking libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Selecting previously unselected package xfonts-encodings.
Preparing to unpack .../35-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb ...
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) ...
Selecting previously unselected package xfonts-utils.
Preparing to unpack .../36-xfonts-utils_1%3a7.7+6build2_amd64.deb ...
Unpacking xfonts-utils (1:7.7+6build2) ...
Selecting previously unselected package lmodern.
Preparing to unpack .../37-lmodern_2.004.5-6.1_all.deb ...
Unpacking lmodern (2.004.5-6.1) ...
Selecting previously unselected package preview-latex-style.

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Preparing to unpack .../38-preview-latex-style_12.2-1ubuntu1_all.deb ...
Unpacking preview-latex-style (12.2-1ubuntu1) ...
Selecting previously unselected package t1utils.
Preparing to unpack .../39-t1utils_1.41-4build2_amd64.deb ...
Unpacking t1utils (1.41-4build2) ...
Selecting previously unselected package teckit.
Preparing to unpack .../40-teckit_2.5.11+ds1-1_amd64.deb ...
Unpacking teckit (2.5.11+ds1-1) ...
Selecting previously unselected package tex-gyre.
Preparing to unpack .../41-tex-gyre_20180621-3.1_all.deb ...
Unpacking tex-gyre (20180621-3.1) ...
Selecting previously unselected package texlive-binaries.
Preparing to unpack .../42-texlive-
binaries_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package texlive-base.
Preparing to unpack .../43-texlive-base_2021.20220204-1_all.deb ...
Unpacking texlive-base (2021.20220204-1) ...
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack .../44-texlive-fonts-recommended_2021.20220204-1_all.deb ...
Unpacking texlive-fonts-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-base.
Preparing to unpack .../45-texlive-latex-base_2021.20220204-1_all.deb ...
Unpacking texlive-latex-base (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack .../46-texlive-latex-recommended_2021.20220204-1_all.deb ...
Unpacking texlive-latex-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive.
Preparing to unpack .../47-texlive_2021.20220204-1_all.deb ...
Unpacking texlive (2021.20220204-1) ...
Selecting previously unselected package libfontbox-java.
Preparing to unpack .../48-libfontbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libfontbox-java (1:1.8.16-2) ...
Selecting previously unselected package libpdfbox-java.
Preparing to unpack .../49-libpdfbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libpdfbox-java (1:1.8.16-2) ...
Selecting previously unselected package texlive-pictures.
Preparing to unpack .../50-texlive-pictures_2021.20220204-1_all.deb ...
Unpacking texlive-pictures (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack .../51-texlive-latex-extra_2021.20220204-1_all.deb ...
Unpacking texlive-latex-extra (2021.20220204-1) ...
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack .../52-texlive-plain-generic_2021.20220204-1_all.deb ...
Unpacking texlive-plain-generic (2021.20220204-1) ...
Selecting previously unselected package tipa.
Preparing to unpack .../53-tipa_2%3a1.3-21_all.deb ...
Unpacking tipa (2:1.3-21) ...

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Selecting previously unselected package texlive-xetex.
Preparing to unpack .../54-texlive-xetex_2021.20220204-1_all.deb ...
Unpacking texlive-xetex (2021.20220204-1) ...
Setting up fonts-lato (2.0-2.1) ...
Setting up fonts-noto-mono (20201225-1build1) ...
Setting up libwoff1:amd64 (1.0.2-1build4) ...
Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libijs-0.35:amd64 (0.35-15build2) ...
Setting up libtexluaajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libfontbox-java (1:1.8.16-2) ...
Setting up rubygems-integration (1.18) ...
Setting up libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Setting up fonts-urw-base35 (20200910-1) ...
Setting up poppler-data (0.4.11-1) ...
Setting up tex-common (6.17) ...
update-language: texlive-base not installed and configured, doing nothing!
Setting up libfontenc1:amd64 (1:1.1.4-1build3) ...
Setting up libjbig2dec0:amd64 (0.19-3build2) ...
Setting up libteckit0:amd64 (2.5.11+ds1-1) ...
Setting up libapache-pom-java (18-1) ...
Setting up ruby-net-telnet (0.1.1-2) ...
Setting up xfonts-encodings (1:1.0.5-0ubuntu2) ...
Setting up t1utils (1.41-4build2) ...
Setting up libidn12:amd64 (1.38-4ubuntu1) ...
Setting up fonts-texgyre (20180621-3.1) ...
Setting up libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up ruby-webrick (1.7.0-3) ...
Setting up fonts-lmodern (2.004.5-6.1) ...
Setting up fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Setting up ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Setting up libsynchronet2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libgs9-common (9.55.0~dfsg1-0ubuntu5.6) ...
Setting up teckit (2.5.11+ds1-1) ...
Setting up libpdfbox-java (1:1.8.16-2) ...
Setting up libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.6) ...
Setting up preview-latex-style (12.2-1ubuntu1) ...
Setting up libcommons-parent-java (43-1) ...
Setting up dvisvgm (2.13.1-1) ...
Setting up libcommons-logging-java (1.2-2) ...
Setting up xfonts-utils (1:7.7+6build2) ...
Setting up libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6.1) ...
Setting up texlive-base (2021.20220204-1) ...

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```

/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN...
mktexlsr: Updating /var/lib/texmf/ls-R...
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4: /var/lib/texmf/tex/generic/tex-
ini-files/pdftexconfig.tex
Setting up tex-gyre (20180621-3.1) ...
Setting up texlive-plain-generic (2021.20220204-1) ...
Setting up texlive-latex-base (2021.20220204-1) ...
Setting up texlive-latex-recommended (2021.20220204-1) ...
Setting up texlive-pictures (2021.20220204-1) ...
Setting up texlive-fonts-recommended (2021.20220204-1) ...
Setting up tipa (2:1.3-21) ...
Setting up texlive (2021.20220204-1) ...
Setting up texlive-latex-extra (2021.20220204-1) ...
Setting up texlive-xetex (2021.20220204-1) ...
Setting up rake (13.0.6-2) ...
Setting up libruby3.0:amd64 (3.0.2-7ubuntu2.4) ...
Setting up ruby3.0 (3.0.2-7ubuntu2.4) ...
Setting up ruby (1:3.0~exp1) ...
Setting up ruby-rubygems (3.3.5-2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) ...
Processing triggers for libc-bin (2.35-0ubuntu3.4) ...
/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

Processing triggers for tex-common (6.17) ...
Running updmap-sys. This may take some time... done.

```



```
Running mktexlsr /var/lib/texmf ... done.
Building format(s) --all.
    This may take some time... done.
Collecting py pandoc
  Downloading py pandoc-1.13-py3-none-any.whl (21 kB)
Installing collected packages: py pandoc
Successfully installed py pandoc-1.13
```

```
[27]: !jupyter nbconvert --to PDF "/content/drive/MyDrive/Colab Notebooks/DSBDAL-9.
↪ipynb"
```

```
[NbConvertApp] Converting notebook /content/drive/MyDrive/Colab
Notebooks/DSBDAL-9.ipynb to PDF
[NbConvertApp] Support files will be in DSBDAL-9_files/
[NbConvertApp] Making directory ./DSBDAL-9_files
[NbConvertApp] Making directory ./DSBDAL-9_files
[NbConvertApp] Writing 65178 bytes to notebook.tex
[NbConvertApp] Building PDF
[NbConvertApp] Running xelatex 3 times: ['xelatex', 'notebook.tex', '-quiet']
[NbConvertApp] Running bibtex 1 time: ['bibtex', 'notebook']
[NbConvertApp] WARNING | bibtex had problems, most likely because there were no
citations
[NbConvertApp] PDF successfully created
[NbConvertApp] Writing 81514 bytes to /content/drive/MyDrive/Colab
Notebooks/DSBDAL-9.pdf
```