

Assignment 6 CRL707
Akashdeep Bansal (2016ANZ8049)

Q4

- a) The PESQMOS score results for the various degraded speech with reference to clean speech are shown in Table. I

REFERENCE	DEGRADED	PESQMOS	SAMPLE_FREQ
original.wav	original.wav	4.5	8000Hz
original.wav	degraded_Q_5.wav	2.817	8000Hz
original.wav	degraded_Q_10.wav	3.200	8000 Hz
original.wav	degraded_Q_15.wav	3.589	8000 Hz
original.wav	degraded_Q_20.wav	3.965	8000 Hz
original.wav	degraded_Q_25.wav	4.225	8000 Hz
original.wav	degraded_Q_30.wav	4.417	8000 Hz
original.wav	degraded_Q_35.wav	4.465	8000 Hz
original.wav	degraded_cocktail.wav	1.944	8000 Hz
original.wav	degraded_traffic.wav	2.198	8000 Hz
original.wav	degraded_door.wav	2.942	8000 Hz

Table I PESQ MOS for different combinations of clean and degraded speech

How does MOS score vary with Q? Why?

Q denotes the value of SNR in dB. High SNR value depicts better intelligibility and Quality. By intuition, we can say that MOS score should improve with the increment in Q value. Same can be infer from the obtained MOS score mentioned in above table.

Comment on your result in 4.a.i. above

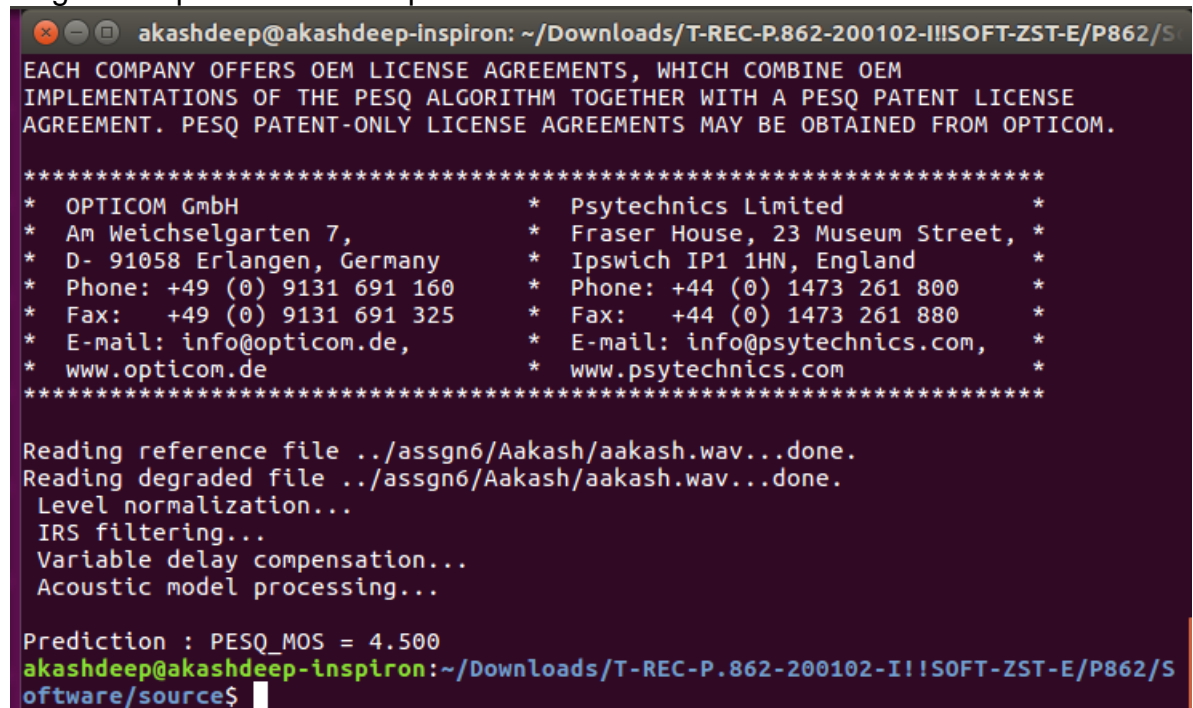
In 4.a.i above the reference and the degraded speech are the same. Hence, we get a maximum score PESQMOS= 4.5.

What do you conclude by comparing results in 4.a.iii, iv, and v?

If We see the Table-I and Compare the scores in 4.a.iii,iv and v, we can conclude that PESQMOS value of cocktail noise is very less compared to other two values i.e., 1.5, next PESQMOS of traffic noise is greater than cocktail noise but less than door slam noise. i.e., 2.071, And for door slam noise = 2.285

We have worked on Ubuntu system and compiled the code using the gcc compiler. The results for various examinations are shown in the snapshots of the terminal below –

i. Degraded speech = Clean speech



```
akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
*   OPTICOM GmbH                               * Psytechnics Limited          *
*   Am Weichselgarten 7,                       * Fraser House, 23 Museum Street, *
*   D- 91058 Erlangen, Germany                 * Ipswich IP1 1HN, England      *
*   Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800    *
*   Fax:   +49 (0) 9131 691 325                 * Fax:   +44 (0) 1473 261 880    *
*   E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,  *
*   www.opticom.de                             * www.psytechnics.com          *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 4.500
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$
```

ii. MNRU (Modulated Noise Reference Unit): Q = 5 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax:   +49 (0) 9131 691 325                 * Fax:   +44 (0) 1473 261 880     *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q5.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 2.817
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

Q = 10 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax:   +49 (0) 9131 691 325                 * Fax:   +44 (0) 1473 261 880     *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q10.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 3.200
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

Q = 15 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax:   +49 (0) 9131 691 325                 * Fax:   +44 (0) 1473 261 880     *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q15.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 3.589
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
oftware/source$

```

Q = 20 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax:   +49 (0) 9131 691 325                 * Fax:   +44 (0) 1473 261 880     *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q20.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 3.965
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
oftware/source$

```

Q = 25 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880      *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q25.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 4.225
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

Q = 30 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880      *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q30.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 4.417
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

Q = 35 dB

```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited                *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England        *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800     *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880      *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,   *
* www.opticom.de                             * www.psytechnics.com            *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_Q35.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 4.465
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

- iii. Degraded speech = Clean speech + cocktail party noise.

```
akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-III!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England *
* Phone: +49 (0) 9131 691 160                  * Phone: +44 (0) 1473 261 800 *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880 *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com, *
* www.opticom.de                             * www.psytechnics.com *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_cocktail.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 1.944
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-III!SOFT-ZST-E/P862/S
oftware/source$
```

- iv. Degraded speech = Clean speech + traffic noise.

```
akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-III!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                                * Psytechnics Limited *
* Am Weichselgarten 7,                        * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                  * Ipswich IP1 1HN, England *
* Phone: +49 (0) 9131 691 160                  * Phone: +44 (0) 1473 261 800 *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880 *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com, *
* www.opticom.de                             * www.psytechnics.com *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_traffic.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 2.198
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-III!SOFT-ZST-E/P862/S
oftware/source$
```

- v. Degraded speech = Clean speech + door slam noise.


```

akashdeep@akashdeep-inspiron: ~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
EACH COMPANY OFFERS OEM LICENSE AGREEMENTS, WHICH COMBINE OEM
IMPLEMENTATIONS OF THE PESQ ALGORITHM TOGETHER WITH A PESQ PATENT LICENSE
AGREEMENT. PESQ PATENT-ONLY LICENSE AGREEMENTS MAY BE OBTAINED FROM OPTICOM.

*****
* OPTICOM GmbH                               * Psytechnics Limited          *
* Am Weichselgarten 7,                       * Fraser House, 23 Museum Street, *
* D- 91058 Erlangen, Germany                 * Ipswich IP1 1HN, England      *
* Phone: +49 (0) 9131 691 160                 * Phone: +44 (0) 1473 261 800    *
* Fax: +49 (0) 9131 691 325                   * Fax: +44 (0) 1473 261 880     *
* E-mail: info@opticom.de,                   * E-mail: info@psytechnics.com,  *
* www.opticom.de                             * www.psytechnics.com          *
*****

Reading reference file ../assgn6/Aakash/aakash.wav...done.
Reading degraded file ../assgn6/Aakash/aakash_door.wav...done.
Level normalization...
IRS filtering...
Variable delay compensation...
Acoustic model processing...

Prediction : PESQ_MOS = 2.942
akashdeep@akashdeep-inspiron:~/Downloads/T-REC-P.862-200102-I!!SOFT-ZST-E/P862/S
software/source$

```

b) Now on using degraded speech as reference in 4.a iii,

REFERENCE	DEGRADED	PESQMOS	SAMPLE_FREQ
degraded_cocktail.wav	original.wav	0.310	8000

What do you conclude about objective tests from 4.b.above?

When we have used degraded speech as reference and evaluated MOS score of the original speech, we got very low MOS score. Because the script evaluate quality with respect to the reference speech. Whereas, if we have done same test with human beings then we have got very high MOS score. This tells us that it is highly important to make sure that the quality of reference speech should be very good for evaluation using PESQ script