Haley Park ID: 923812276
Github: jung-hyeon CSC415 Operating Systems

Assignment 5 – Buffered I/O

Description:
This assignment involves the implementation of buffered I/O operations in C, where the buffering is managed manually. Three functions need to be written: b_open, b_read, and b_close, as specified in the provided b_io.h file. b_open is responsible for returning a file descriptor and allocating a buffer. b_read is tasked with reading data in chunks of size B_CHUNK_SIZE and copying appropriate bytes to the caller's buffer. b_close should handle freeing any allocated resources. Low-level APIs like LBAread and GetFileInfo will be utilized for file operations. The b_read function must address cases where the read request exceeds the buffer size, and it should keep track of the file size, returning 0 upon reaching the end of the file.

Approach:
Assumption

- File is contiguous in this assignment
- In b_open function, Ignore flags in this assignment

1. b_open function
    a. Get file information
        i. By using GetFileInfo function, get file information
        ii. If file is not found, return -1 (ERROR)
    b. Get file control block
        i. By using b_getFCB function, get file descriptor
        ii. If there is no available FCB, return -1 (ERROR)
    c. Allocate memory for buffer
        i. By using malloc, allocate memory size of B_CHUNK_SIZE
        ii. If memory allocation is failed, return -1 (ERROR)
    d. Populate the FCB with necessary information
        i. Initialize variables like fi, buffer, buf_index, buf_remain, block_count, and file_index
    e. Return the file descriptor
2. b_read function
    a. If the user requested bytes is bigger than file size, change the user requested bytes to remained file bytes
    b. If bytes that remain in own buffer is bigger than user requested bytes,
        i. Directly buffer from own buffer to caller's buffer (not need to LBAread) because own buffer already has bytes
        ii. ⇒ Copy memory as many bytes as user wants directly from own buffer
    c. Else, Need to use LBAread to get data (need to get new data)
        i. Copy memory from own buffer if it is not empty (Before get new data)
        ii. ⇒ Copy memory as many bytes as bytes remained in own buffer

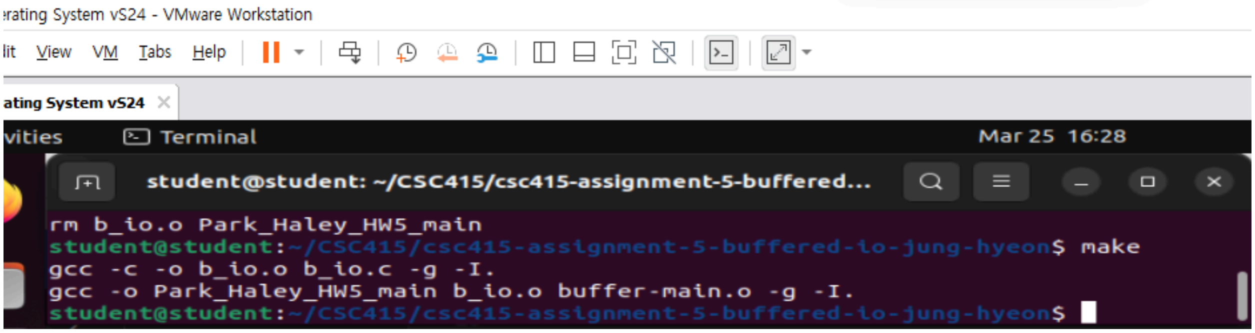
        iii. If bytes wanted by user is bigger than B_CHUNK_SIZE, buffer directly from file to user buffer
            1. Calculate needed lba_count
            2. LBAread from file to buffer as many blocks as needed
        iv. Read B_CHUNK_SIZE a byte chunks from LBAread into the buffer
        v. Buffer the remaining bytes that user wants from own buffer to user buffer
    d. Track file index
    e. Return read bytes count
3. b_close function
    a. Free the buffer associated with the file
    b. Reset the file control block

Issues and Resolutions:

1. Using LBAread
    a. First, I assign 0 for LBAread’s last parameter. But It’s not right. I always got the same strings. So I changed it by using the file's location.
    b. When the bytes wanted by the user are bigger than B_CHUNK_SIZE, I used a while loop for the first time. But I can get multiple B_CHUNK_SIZE at one time. So I changed LBAread’s second parameter to lba_count
        i. EX) int lba_count = (count - read_count) / B_CHUNK_SIZE;

Analysis: N/A

Screen shot of compilation:



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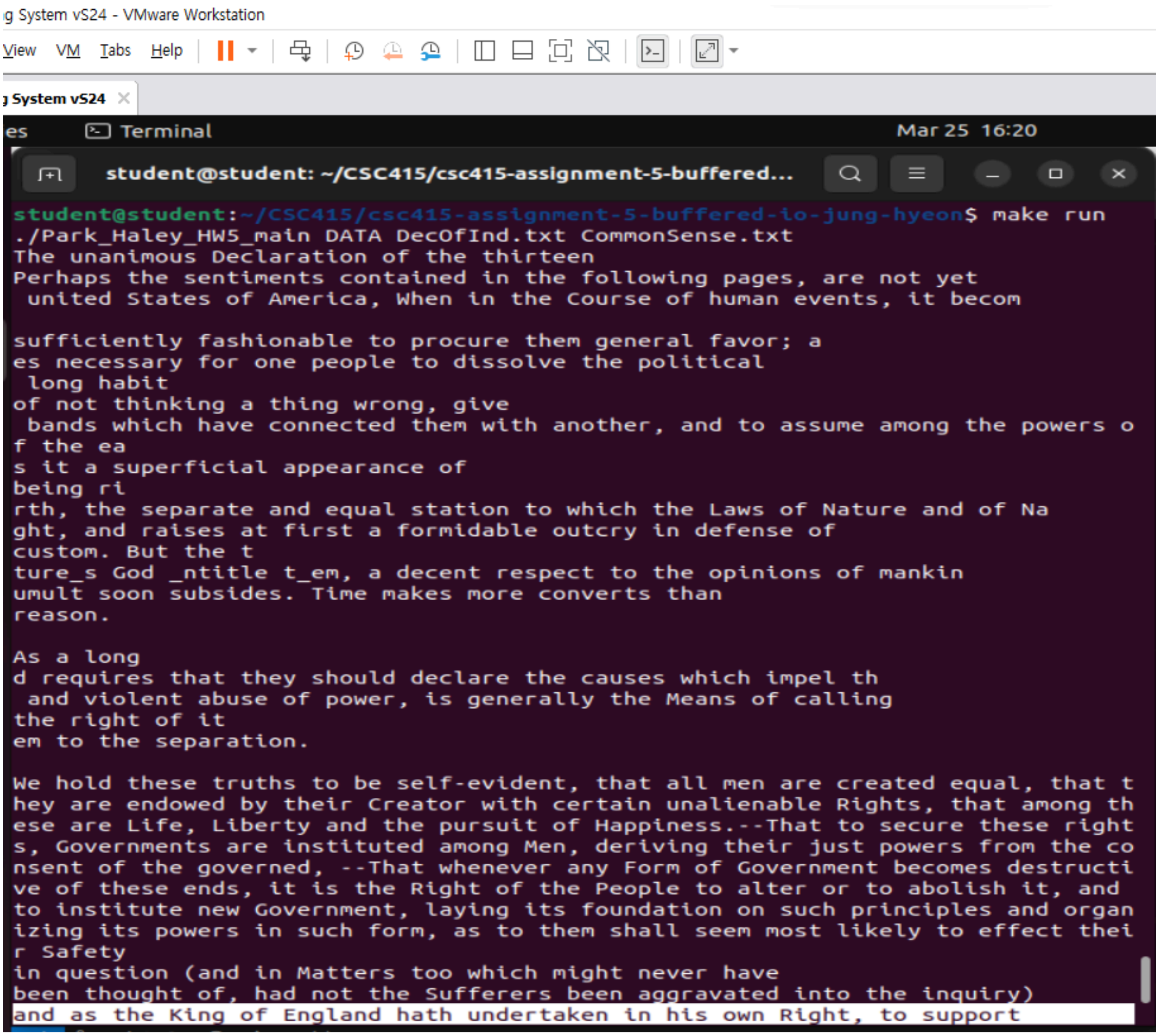
```
rm b_io.o Park_Haley_HW5_main
student@student:~/CSC415/csc415-assignment-5-buffered-io-jung-hyeon$ make
gcc -c -o b_io.o b_io.c -g -I.
gcc -o Park_Haley_HW5_main b_io.o buffer-main.o -g -I.
student@student:~/CSC415/csc415-assignment-5-buffered-io-jung-hyeon$ 
```

Screen shot(s) of the execution of the program: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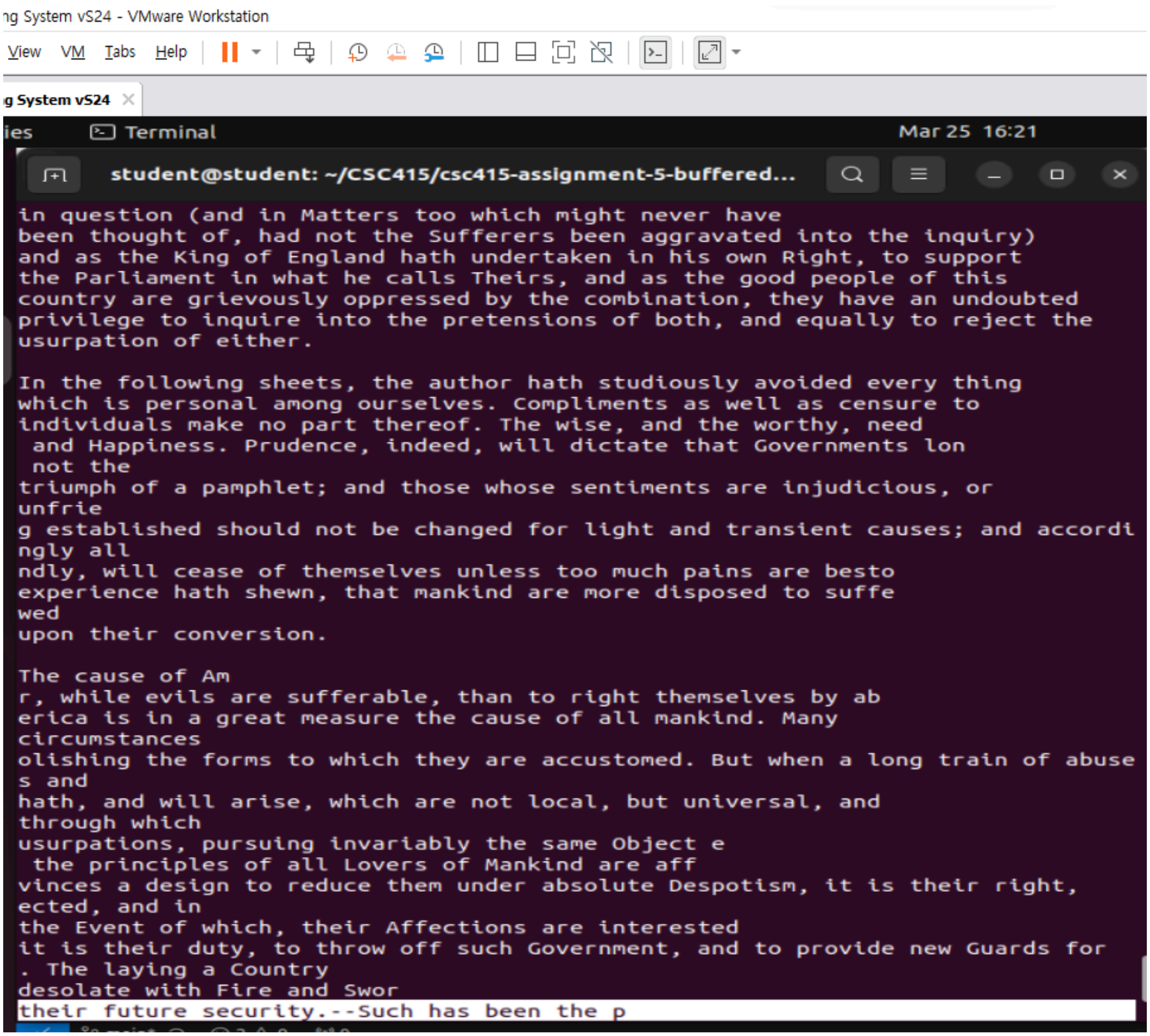
```
student@student:~/CSC415/csc415-assignment-5-buffered-io-jung-hyeon$ make run
./Park_Haley_HW5_main DATA DecOfInd.txt CommonSense.txt
The unanimous Declaration of the thirteen
Perhaps the sentiments contained in the following pages, are not yet
 united States of America, When in the Course of human events, it becom

sufficiently fashionable to procure them general favor; a
es necessary for one people to dissolve the political
 long habit
of not thinking a thing wrong, give
 bands which have connected them with another, and to assume among the powers o
f the ea
s it a superficial appearance of
being ri
rth, the separate and equal station to which the Laws of Nature and of Na
ght, and raises at first a formidable outcry in defense of
custom. But the t
ture_s God _ntitle t_em, a decent respect to the opinions of mankin
umult soon subsides. Time makes more converts than
reason.

As a long
d requires that they should declare the causes which impel th
 and violent abuse of power, is generally the Means of calling
the right of it
em to the separation.

We hold these truths to be self-evident, that all men are created equal, that t
hey are endowed by their Creator with certain unalienable Rights, that among th
ese are Life, Liberty and the pursuit of Happiness.--That to secure these right
s, Governments are instituted among Men, deriving their just powers from the co
nsent of the governed, --That whenever any Form of Government becomes destructi
ve of these ends, it is the Right of the People to alter or to abolish it, and
to institute new Government, laying its foundation on such principles and organ
izing its powers in such form, as to them shall seem most likely to effect thei
r Safety
in question (and in Matters too which might never have
been thought of, had not the Sufferers been aggravated into the inquiry)
and as the King of England hath undertaken in his own Right, to support
```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```
in question (and in Matters too which might never have
been thought of, had not the Sufferers been aggravated into the inquiry)
and as the King of England hath undertaken in his own Right, to support
the Parliament in what he calls Theirs, and as the good people of this
country are grievously oppressed by the combination, they have an undoubted
privilege to inquire into the pretensions of both, and equally to reject the
usurpation of either.

In the following sheets, the author hath studiously avoided every thing
which is personal among ourselves. Compliments as well as censure to
individuals make no part thereof. The wise, and the worthy, need
 and Happiness. Prudence, indeed, will dictate that Governments lon
 not the
triumph of a pamphlet; and those whose sentiments are injudicious, or
unfrie
g established should not be changed for light and transient causes; and accordi
ngly all
ndly, will cease of themselves unless too much pains are besto
experience hath shewn, that mankind are more disposed to suffe
wed
upon their conversion.

The cause of Am
r, while evils are sufferable, than to right themselves by ab
erica is in a great measure the cause of all mankind. Many
circumstances
olishing the forms to which they are accustomed. But when a long train of abuse
s and
hath, and will arise, which are not local, but universal, and
through which
usurpations, pursuing invariably the same Object e
 the principles of all Lovers of Mankind are aff
vinces a design to reduce them under absolute Despotism, it is their right,
ected, and in
the Event of which, their Affections are interested
it is their duty, to throw off such Government, and to provide new Guards for
. The laying a Country
desolate with Fire and Swor
their future security.--Such has been the p
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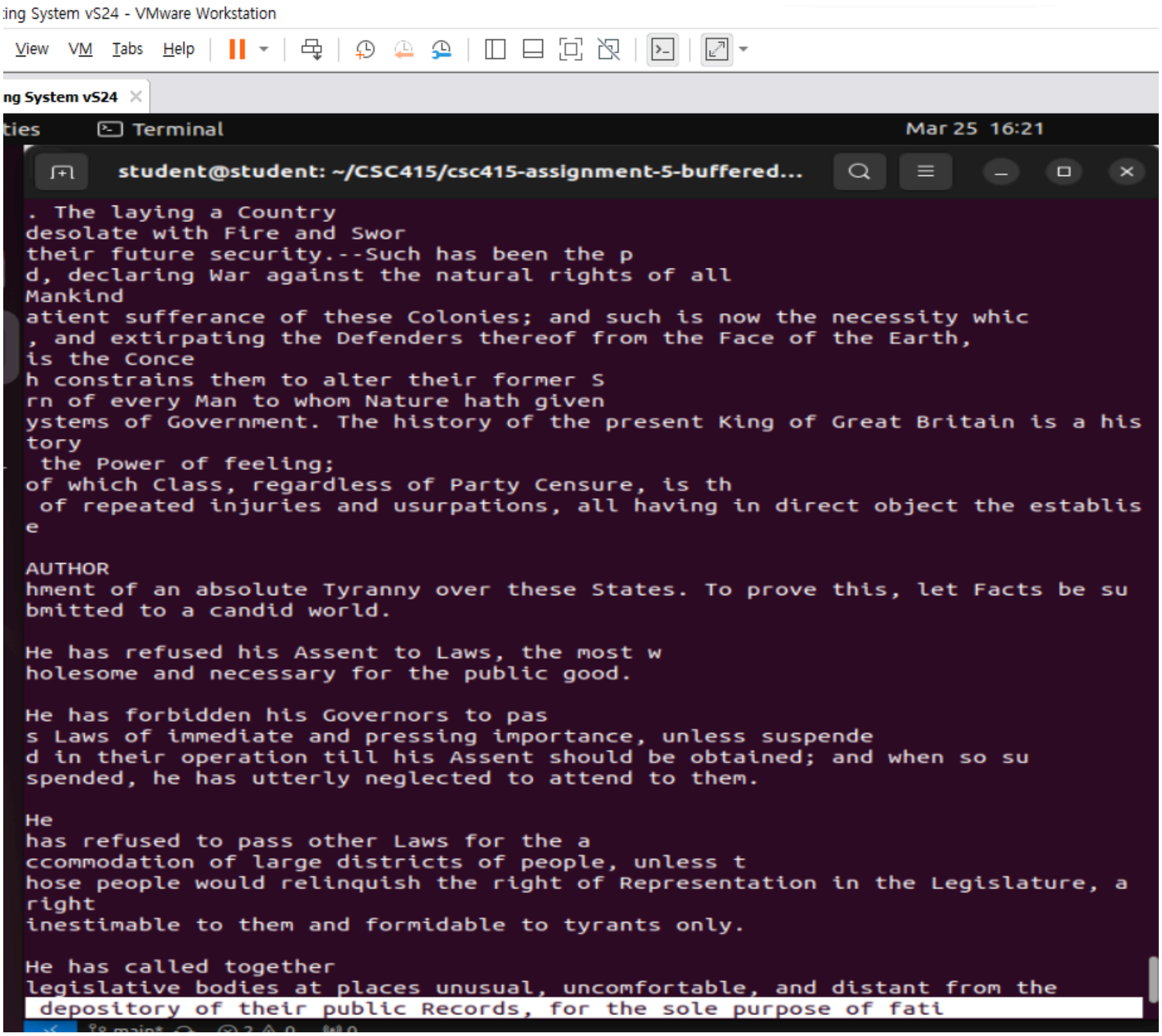
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```
. The laying a Country
desolate with Fire and Swor
their future security.--Such has been the p
d, declaring War against the natural rights of all
Mankind
atient sufferance of these Colonies; and such is now the necessity whic
, and extirpating the Defenders thereof from the Face of the Earth,
is the Conce
h constrains them to alter their former S
rn of every Man to whom Nature hath given
ystems of Government. The history of the present King of Great Britain is a his
tory
 the Power of feeling;
of which Class, regardless of Party Censure, is th
 of repeated injuries and usurpations, all having in direct object the establis
e

AUTHOR
hment of an absolute Tyranny over these States. To prove this, let Facts be su
bmitted to a candid world.

He has refused his Assent to Laws, the most w
holesome and necessary for the public good.

He has forbidden his Governors to pas
s Laws of immediate and pressing importance, unless suspende
d in their operation till his Assent should be obtained; and when so su
spended, he has utterly neglected to attend to them.

He
has refused to pass other Laws for the a
ccommodation of large districts of people, unless t
hose people would relinquish the right of Representation in the Legislature, a
right
inestimable to them and formidable to tyrants only.

He has called together
legislative bodies at places unusual, uncomfortable, and distant from the
 depository of their public Records, for the sole purpose of fati
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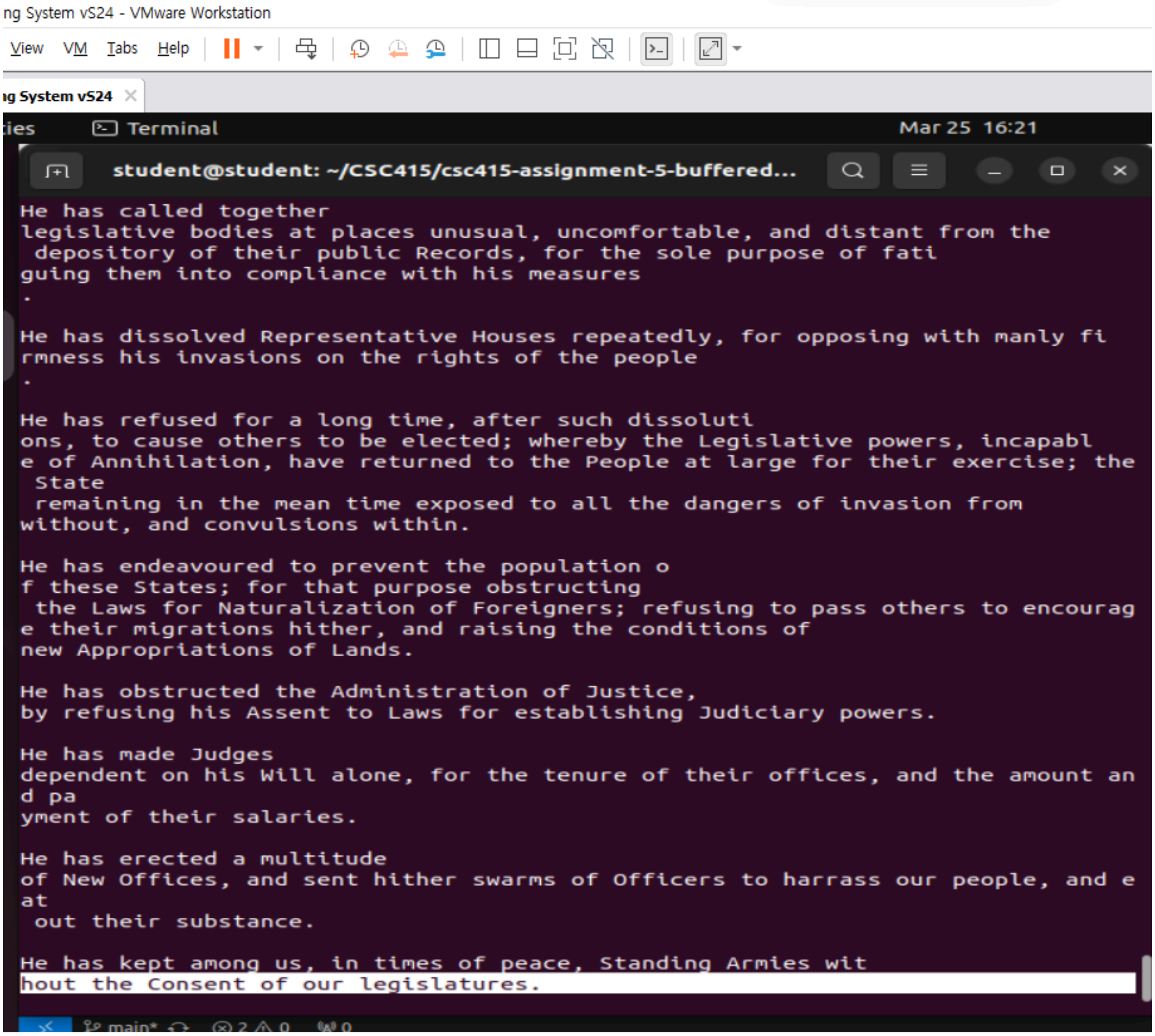
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He has called together
legislative bodies at places unusual, uncomfortable, and distant from the
 depository of their public Records, for the sole purpose of fati
guing them into compliance with his measures
.

He has dissolved Representative Houses repeatedly, for opposing with manly fi
rmness his invasions on the rights of the people
.

He has refused for a long time, after such dissoluti
ons, to cause others to be elected; whereby the Legislative powers, incapabl
e of Annihilation, have returned to the People at large for their exercise; the
 State
 remaining in the mean time exposed to all the dangers of invasion from
without, and convulsions within.

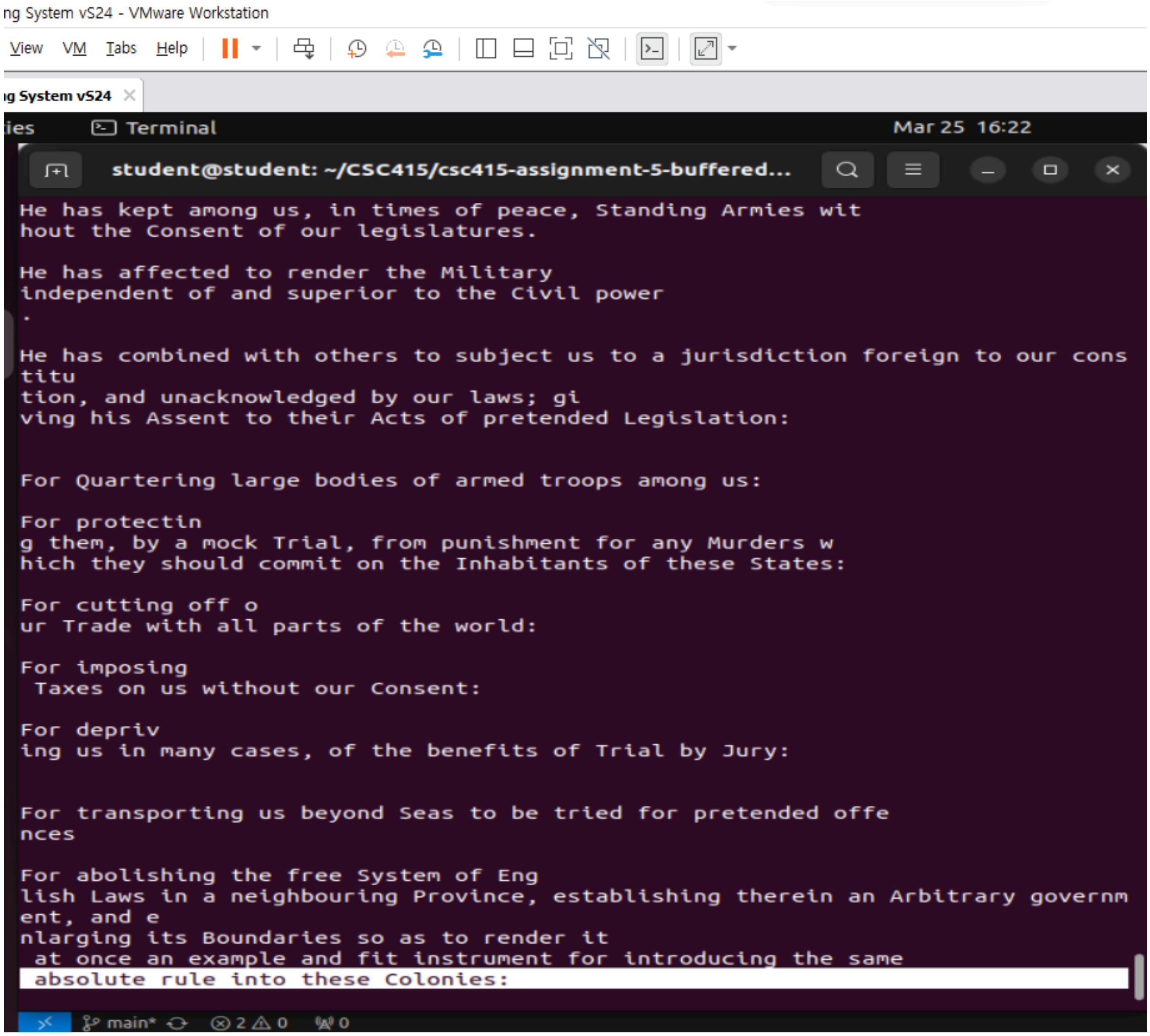
He has endeavoured to prevent the population o
f these States; for that purpose obstructing
 the Laws for Naturalization of Foreigners; refusing to pass others to encourag
e their migrations hither, and raising the conditions of
new Appropriations of Lands.

He has obstructed the Administration of Justice,
by refusing his Assent to Laws for establishing Judiciary powers.

He has made Judges
dependent on his Will alone, for the tenure of their offices, and the amount an
d pa
yment of their salaries.

He has erected a multitude
of New Offices, and sent hither swarms of Officers to harrass our people, and e
at
 out their substance.

He has kept among us, in times of peace, Standing Armies wit
hout the Consent of our legislatures.
```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He has kept among us, in times of peace, Standing Armies wit
hout the Consent of our legislatures.

He has affected to render the Military
independent of and superior to the Civil power
.

He has combined with others to subject us to a jurisdiction foreign to our cons
titu
tion, and unacknowledged by our laws; gi
ving his Assent to their Acts of pretended Legislation:


For Quartering large bodies of armed troops among us:

For protectin
g them, by a mock Trial, from punishment for any Murders w
hich they should commit on the Inhabitants of these States:

For cutting off o
ur Trade with all parts of the world:

For imposing
 Taxes on us without our Consent:

For depriv
ing us in many cases, of the benefits of Trial by Jury:


For transporting us beyond Seas to be tried for pretended offe
nces

For abolishing the free System of Eng
lish Laws in a neighbouring Province, establishing therein an Arbitrary governm
ent, and e
nlarging its Boundaries so as to render it
 at once an example and fit instrument for introducing the same
 absolute rule into these Colonies:
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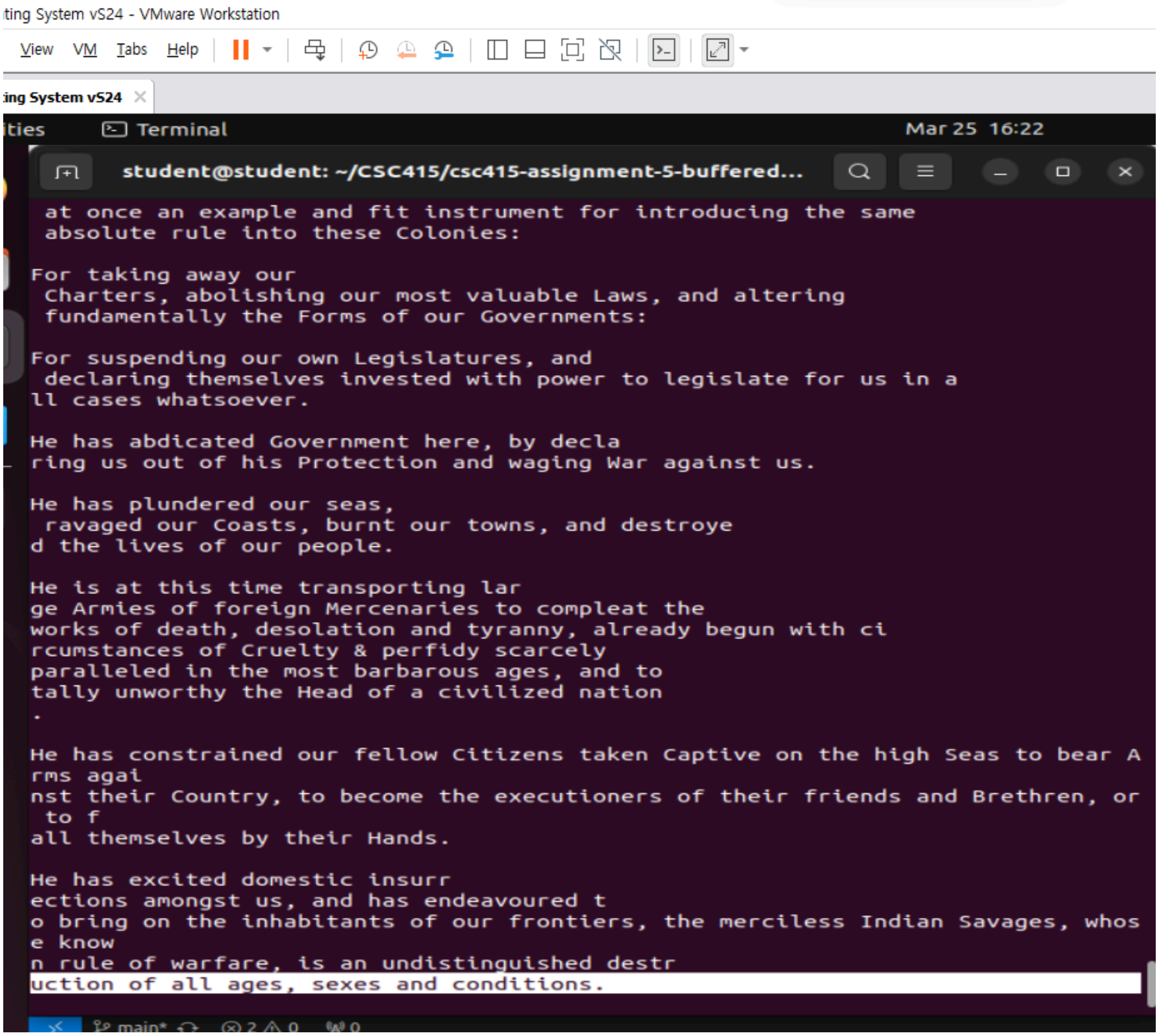
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```
 at once an example and fit instrument for introducing the same
 absolute rule into these Colonies:

For taking away our
 Charters, abolishing our most valuable Laws, and altering
 fundamentally the Forms of our Governments:

For suspending our own Legislatures, and
 declaring themselves invested with power to legislate for us in a
ll cases whatsoever.

He has abdicated Government here, by decla
ring us out of his Protection and waging War against us.

He has plundered our seas,
 ravaged our Coasts, burnt our towns, and destroye
d the lives of our people.

He is at this time transporting lar
ge Armies of foreign Mercenaries to compleat the
works of death, desolation and tyranny, already begun with ci
rcumstances of Cruelty & perfidy scarcely
paralleled in the most barbarous ages, and to
tally unworthy the Head of a civilized nation
.

He has constrained our fellow Citizens taken Captive on the high Seas to bear A
rms agai
nst their Country, to become the executioners of their friends and Brethren, or
 to f
all themselves by their Hands.

He has excited domestic insurr
ections amongst us, and has endeavoured t
o bring on the inhabitants of our frontiers, the merciless Indian Savages, whos
e know
n rule of warfare, is an undistinguished destr
uction of all ages, sexes and conditions.
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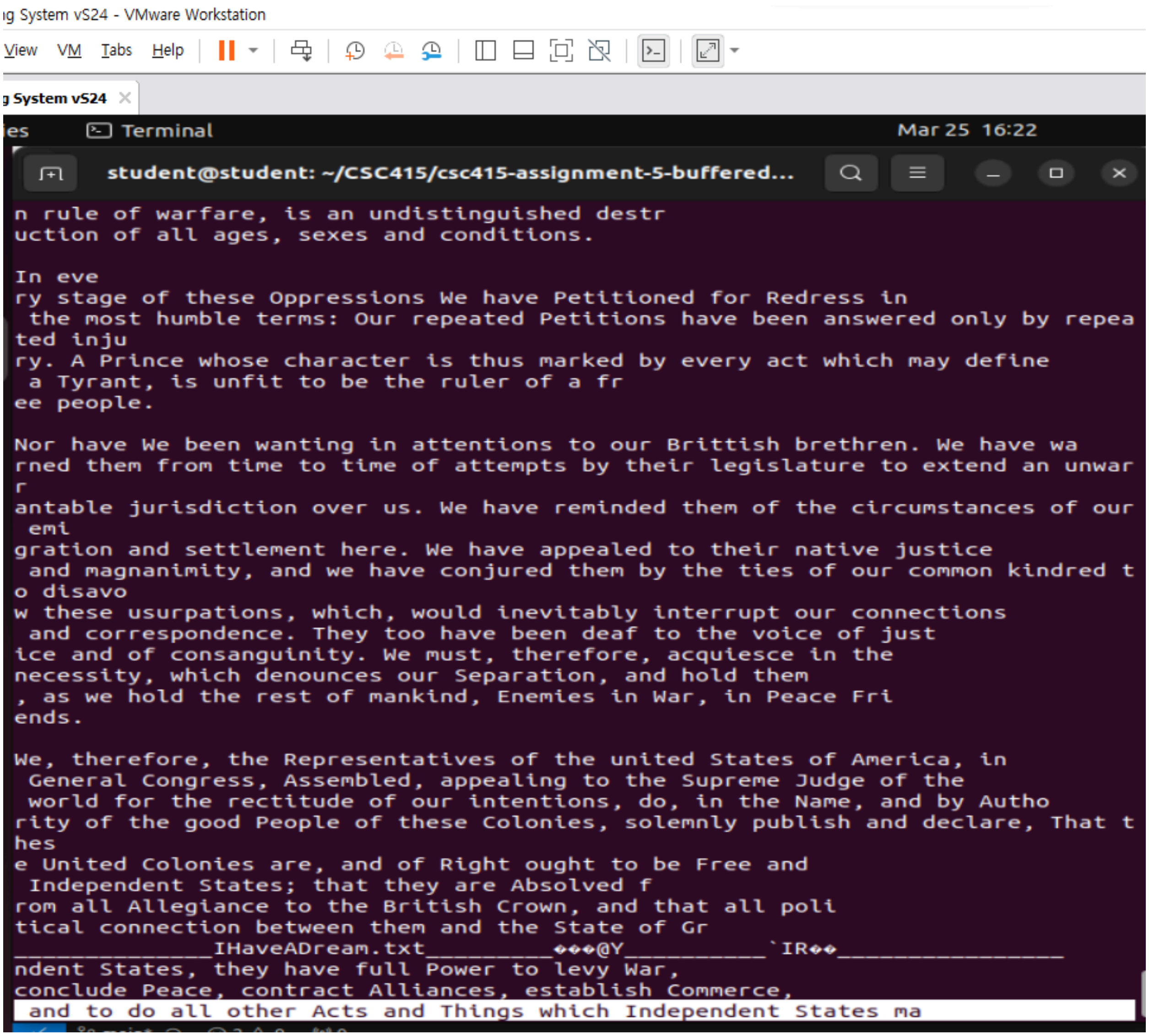
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```
n rule of warfare, is an undistinguished destr
uction of all ages, sexes and conditions.

In eve
ry stage of these Oppressions We have Petitioned for Redress in
 the most humble terms: Our repeated Petitions have been answered only by repea
ted inju
ry. A Prince whose character is thus marked by every act which may define
 a Tyrant, is unfit to be the ruler of a fr
ee people.

Nor have We been wanting in attentions to our Brittish brethren. We have wa
rned them from time to time of attempts by their legislature to extend an unwar
r
antable jurisdiction over us. We have reminded them of the circumstances of our
 emi
gration and settlement here. We have appealed to their native justice
 and magnanimity, and we have conjured them by the ties of our common kindred t
o disavo
w these usurpations, which, would inevitably interrupt our connections
 and correspondence. They too have been deaf to the voice of just
ice and of consanguinity. We must, therefore, acquiesce in the
necessity, which denounces our Separation, and hold them
, as we hold the rest of mankind, Enemies in War, in Peace Fri
ends.

We, therefore, the Representatives of the united States of America, in
 General Congress, Assembled, appealing to the Supreme Judge of the
 world for the rectitude of our intentions, do, in the Name, and by Autho
rity of the good People of these Colonies, solemnly publish and declare, That t
hes
e United Colonies are, and of Right ought to be Free and
 Independent States; that they are Absolved f
rom all Allegiance to the British Crown, and that all poli
tical connection between them and the State of Gr
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ndent States, they have full Power to levy War,
conclude Peace, contract Alliances, establish Commerce,
 and to do all other Acts and Things which Independent States ma
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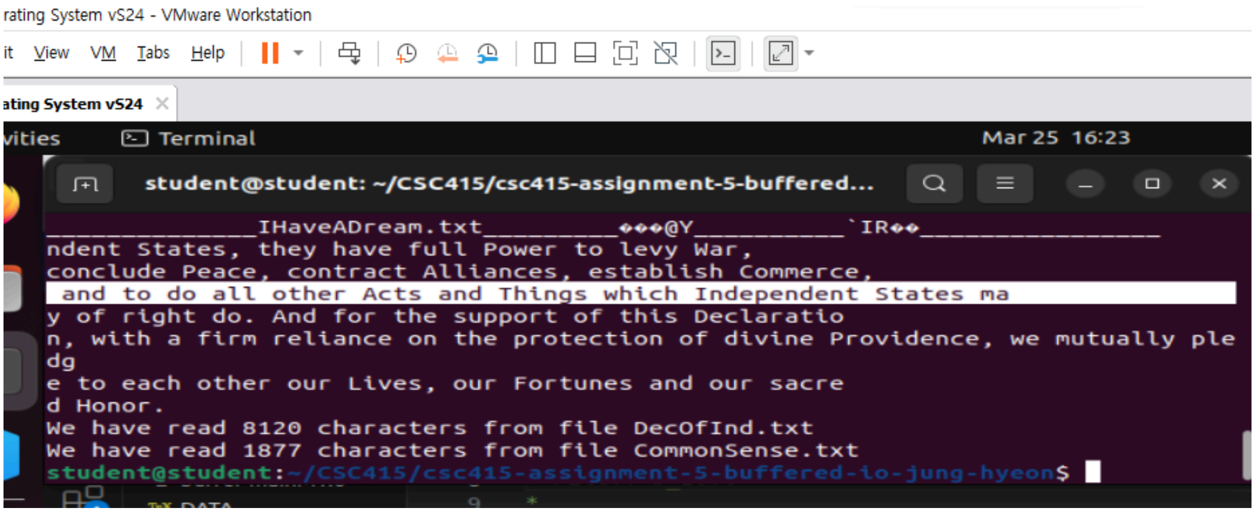
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ndent States, they have full Power to levy War,
conclude Peace, contract Alliances, establish Commerce,
 and to do all other Acts and Things which Independent States ma
y of right do. And for the support of this Declaratio
n, with a firm reliance on the protection of divine Providence, we mutually ple
dg
e to each other our Lives, our Fortunes and our sacre
d Honor.
We have read 8120 characters from file DecOfInd.txt
We have read 1877 characters from file CommonSense.txt
student@student:~/CSC415/csc415-assignment-5-buffered-io-jung-hyeon$ 
```