# **ENGG2400**

# AYWWUb]Wg`cZGc`]Xg`%



eba

ENGG2400 // Term 1, 2022 // published at 09-02-2022 © UNSW Sydney, 2022

# 7 ci fgY<sup>-</sup>Cj Yfj ]Yk

## GHJZZ7cbHJWh78YHJ]`g

#### 7cbj Ybcfg

B Ua Y	9a U]`	5j U]`UV]`]m	@cWUhjcb	D\cbY
8Ub]Y`CfG\YU	<u>X"cg\YU4_i bgk "YXi "Ui_</u>	9a U]`Zcf Uddc]bha Ybh	Fcca <sup>:</sup> %\$, ž <&\$	

#### @Y₩ni fYfg

B Ua Y	9a U]`	5j U]`UV]`] <b>m</b>	@cWUhjcb	D\cbY
9`YbU 5Hfcg\VXYb_c	<u>Y"Ulfcg\WXYb_c4_i_bgk_"YXi "Ui_</u>		F cca `*\$+ž <&\$	

#### GWXcc``7cbHJWhi=bZcfaUhjcb

<u>9b[]bYYf]b[\_`Gh XYbhGi ddcfhGYfj]WYg</u>`-'H\Y`Bi WYi g`!`Ybfc`a Ybhž'dfc[fYgg]cb`W\YW\_gž'WUg\`fYei Yghgž Vći fgY`]ggi Yg`cf`dfc[fUa !fY`UhYX'ei Yf]Yg`

<u>9b[]bYYf]b[`⊕Xi ghf]U``HfU]b]b[</u>`-`⊕Xi ghf]U``HfU]b]b[ `ei Ygh]cbg`

<u>I BGK 'Gh Xm5VfcUX</u>'-gh XmUVfcUX'gh XYbhYbei ]f]Yg'fZcf']bVci bX'gh XYbhgŁ'

I BGK '9I W.Ub[Y'-ghi XYbhYI W.Ub[Y'Ybei]f]Yg'fZcf']bVci bX'ghi XYbhgŁ

I BGK : i h fY'Gh XYbhg'-'dchYbhJU`'gh XYbhYbei ]f]Yg'Y"["'UXa ]gg]cbgž'ZYYgž'dfc[fUa gž'WfYX]hhfUbgZYf'

#### D\cbY<sup>.</sup>

fŽ\*%'&Ł'-',)',)\$\$`-BiWYig'GhiXYbh'<iV'

fŽ\*%<sup>•</sup>&Ł'-',)`+\*\*%<sup>•</sup>−<sup>•</sup>9b[]bYYf]b[`⊕Xi ghf]U``HfU]b]b[`

fŽ\*%`&Ł'-',)`'%+-`<mark>-</mark>`IBGK `GhiXm5VfcUX`UbX`IBGK `9IWXUb[Y`fZcf`]bVcibX`ghiXYbhgŁ`

# 7cifgY<sup>·</sup>8YHJ]`g

## I b]hg`cZ7fYX]h`\*`

## Gi a a UfmcZh\Y'7ci fgY

H\]gʻWci fgYʻdfcj ]XYgʻUbʻ]bHfcXi Wijcbʻhcʻh\YʻZ bXUa YbHUʻgʻhcʻh\Yʻa YVXUb]WgʻcZgc`]Xg"ʻH\Yʻhcd]Wgʻ]bWi XY dfcdYff}YgʻcZd`UbY`Wfcgg!gYWijcbUʻ`g\UdYgʻ]bWi X]b[`WYbHfc]X´ df]bWijdU``gYWcbX`a ca YbhcZUfYU/ WcbWYdhgʻcZghfYggʻUbX`ghfU]b/&8`HfUbgZcfa UhjcbʻcZghfYggYgʻUbX`ghfU]bgʻi bXYfʻUl ]gʻfchUhjcb/df]bWijdU` ghfYggYgʻUbX`ghfU]bg/A c\f\*gʻWjfWY`cZghfYggʻUbX`ghfU]b/ghfYgg!ghfU]bʻfY`Uhjcbg\]dg/Y`UghjWjmž'h\Yfa U` ghfU]bžDc]ggcb\*gʻfUhjc`UbX`<cc\_Y\*gʻ@Uk /VUfgʻi bXYfʻUl ]U``ZcfWY´+bXYhYfa ]bUhY`Ul ]U``ZcfWY`gmghYa g/ Y`UghjWVYbX]b[`ghfYggʻZcfa i `U/Wca dcg]hY`VYUa g/XYZYWijcbgʻXi Y`hc`VYbX]b[`ghYdʻZ bWijcbg/g]a d`Y ]bXYhYfa ]bUhY`VYUa g/g\YUf`Zck /g\YUf`WfbHY/hcfg]cb`cZWjfW``Uf`g\UZg"

#### 7 ci fgY 5]a g

 $H \ Y \ c \ V \ Y \ W_{j} \ Y \ g \ c \ Z \ h \ ] g \ W_{c} \ i \ fg \ U \ f \ Y.$ 

Hc`fY]bZcfWY`\_bck`YX[Y`cZgHUH]Wg`UbX`hc`YIdUbX`H\]g`\_bck`YX[Y`]b`H\Y`UfYUg`cZgHfU]b`UbX`gHfYgg UbU`mg]gž`H\ig`YbUV`]b[`ghiXYbh'hc`XYU``k]H\`acfY`Wcad`YI`UbX`]bHY[fUHYX`Yb[]bYYf]b[`dfcV`Yag`]bjc`j]b[ AYV\Ub]Wg`cZGc`]Xg/

Hcʻ]bhfcXi Wrʻgh XYbhgʻhcʻh\YʻVUg]Wdf]bWjd`YgʻUbXʻ`Uk gʻi bXYfʻmjb[ʻA YW\Ub]WgʻcZGc`]Xg/ HcʻZJa ]`]Uf]nYʻgh XYbhgʻk ]h\ʻh\Yʻa cXY``]b[ʻUbX`UbU`mg]gʻhYW\b]ei Ygʻk \YbʻZcfa i `Uhjb[`UbXʻgc`j`]b[ dfcV`Ya gʻZcf`dfYX]Wjb[`h\YʻghUhYgʻcZghYggʻUbXʻghfU]bʻZcf`VcX]Ygʻ]bʻghUhjWYei ]`]Vf]i a / Hcʻ[]j Yʻgh XYbhgʻUbʻcddcfh b]mhcʻXYj Y`cdʻUbXʻfYZYWicbʻ[fUXi UhYʻUhf]Vi hYgʻgi W\`UgʻWf]hjWU``h\]b\_]b[`UbX dfcV`Ya ʻgc`j ]b[ž`]ZY`cb[``YUfb]b[ʻg\_]``gʻUbX`Wc``UVcfUhji Y`g\_]``g"

#### 7cifgY`@YUfb]b[`CiHWcaYg

5ZhYfigi VWVggZ ``mWcad`Yh]b[ h\]g'WcifgYžmci ig\ci`X'VY'UV`Y'hc.

@YUfb]b[ CiHWcaY	95 GHJ[Y % 7 ca dYhYbW]Yg	
%"`FYdfYgYbhd\mg]WU``gmghYag`]b`U`aUbbYf`hc`giZ]W]YbhmWUdhifY h\Y`ghfiWhifU``Y`YaYbhg`fYei]fYX`hc`dYfZcfa`Ub`Yb[]bYYf]b[ ghfYgg#ghfU]b`UbU`mg]g"	D9%"%žD9%"&	
&"`8]gWYfb'H\Y`fY`YjUbHdf]bW]d`Yg'H\UHaighVY'Udd`]YX'Hc UgWYffU]b'gHYgg#gHfU]b'cf``cUX#XYZYWf]cb'gHUHYg'cZYb[]bYYf]b[ gmgHYag'UbX'X]gWf]a]bUHY'VYHkYYb'fY`YjUbHUbX']ffY`YjUbh ]bZcfaUH]cb']b'H\Y'WcbHYIH'	D9%"'	
'"`8YacbghfUhY`Ub`UV]`]mihc`Wcaaib]WUhY`WYUf`miUbX`dfYW]gY`m UVcihihYW\b]WU``aUhhYfg`fY`UhYX`hc`h\Y`AYW\Ub]Wg`cZGc`]Xg	D9%" žD9%")	
("`5\WVcad`]g\`dfU\W1j\WU``HJg_g`H\UhfYei]fY`H\Y`Udd`]\WUhjcb`cZ _bck`YX[Y`cZH\Y`AYW\Ub]\Vg`cZGc`]Xg	D9%" žD9%") žD9&"%	
) "`8Ya cbghfUhY`dfcZYgg]cbU``Wca a i b]WUh]cbžVch\`k f]hhYb`UbX cfU`ž'h\Uh`]bWi XYg`a Uh\Ya Uh]WU`ž[ fUd\]WU``UbX`X]U[ fUa a Uh]W Y`Ya Ybhg"	D9%"&ž`D9%"'	

@YUfb]b[ CiHWcaY	95 GHJ[Y %7ca dYhYbW]Yg
*"`DfcXi WY`]bX]j ]Xi U``k cf_`Vm`Yj YfU[]b[`U`Wc``UVcfUhj Y Ybj ]fcba Ybhž`\Y`d]b[`UbX`UbX`fYV]Yj ]b[`\Y`d`Zfca `dYYfg`]b`U dfcZYgg]cbU``UbX`Yh\]WU``a UbbYf"	D9%"&žD9%" žD9&"&

## HYUWX]b[ GhfUhY[]Yg

H\Y`HYUWX]b[`gHfUHY[]Yg`H\Uhik]``VY`i gYX`]bWi XY.`

- @YWi fYg'h Uhk ]``ZcW g'cb'h Y'XYj Y`cda Ybh'UbX'Udd`]WUhjcb'cZ[YbYfU`]gYX'dfcV'Ya !gc`j ]b[ dfcW/ggYg'Zcf'h Y'ghfYggž'ghfU]b'UbX'XYZcfa Uhjcb'UbU'mg]g'cZghfi Wi fYg"'@YWi fYg'k ]``U`gc Ya d\Ug]gY'h Y'fY`Uhjcbg\]d'cZh Y'WcbhYbhhc'Yb[]bYYf]b['dfUWjWY'UbX'k]```dfcj ]XY'Ub'cddcfhi b]hm Zcf'fYZYWjcb'cb'`YUfb]b["'H\Y'`YWi fYg'UfY'fYWcfXYX'UbX'g\ci`X'VY'Uj U]`UV`Y'cb'h\Y'A ccX`Y Wci fgY'dU[Y"
- DfcV<sup>\*</sup>Ya <sup>-</sup>WUggYg<sup>\*</sup>k ]<sup>\*\*</sup>WcbWfblfUlY<sup>\*</sup>cb<sup>\*</sup>glfUlY<sup>\*</sup>[]Yg<sup>\*</sup>Zcf<sup>\*</sup>gc<sup>\*</sup>j ]b[ <sup>\*</sup>gi Wk<sup>\*</sup>dfcV<sup>\*</sup>Ya g<sup>\*\*\*</sup>Gh XYbhg<sup>\*</sup>k ]<sup>\*\*\*</sup>VY YbWci fU[ YXž<sup>\*</sup>Z<sup>\*</sup>ca <sup>\*</sup>h]a Y<sup>\*</sup>hc<sup>\*</sup>h]a Yž<sup>\*</sup>hc<sup>\*</sup>k cf\_<sup>\*\*</sup>]b<sup>\*</sup>ga U<sup>\*\*\*</sup>[ fci dg<sup>\*</sup>hc<sup>\*</sup>gc<sup>\*</sup>j Y<sup>\*</sup>dfcV<sup>\*</sup>Ya g<sup>\*\*</sup>
- A ccX`Y`7 ci fgY`DU[Y`dfcj]XYg`U`ghYd`VmghYd`[i]XY`cb`h\Y`Vci fgY"`H\YfY`]g`U`X]gW gg]cb`Zcfi a hc`\Y`d`dfcj]XY`]bhYfUW]cb`UbX`\Y`d`Zfca`dYYfg"`@]b\_g`hc`j]XYc`fYVcfX]b[g`UbX``YUfb]b[`acXi`Yg hc`\Y`d`ghi XYbhg``YUfb`h\Y`gc`i h]cb`hYV\b]ei Yg`Zcf`a UbmcZh\Y`gi V^WhUfYUg"`
- A ]WfcgcZhiHYUa g

# 5ggYgga Ybh

5ggYgga Ybh'HJg_	K Y][∖h	8iY`8UHY	7cifgY`@YUfb]b[ CihWcaYgʻ5ggYggYX
%"°Cb`]bY`@YUfb]b[ ^A cXi `Yg	%) I		



## FYgci fWg

#### DfYgWf]VYX F Ygci fWfg

HYI H/cc\_. "A YW.Ub]Wg`cZA UHYf]U`g. HYbh. 9X]h]cb`]b`G=I b]hg``!`F 7`<]VVY`Yfž`DYUfgcb`9Xi WUh]cb

#### 7 ci fgY 9j U`i Uh]cb UbX 8Yj Y`cda Ybh

H\Y'GW\cc``cZ7]j ]`UbX'9bj ]fcba YbHJ`'9b[]bYYf]b[ 'Yj U`i UHYg'YUW\ Wci fgY YUW\ 'h]a Y`]h]g'fi b'h\fci [\`f]Ł h\Y'A m9I dYf]YbW''Gi fj YmgžUbX'f]]Ł: cW g'; fci d'A YYh]b[ g"`5g'dUfhcZh\Y'A m9I dYf]YbW''dfcW'ggžmci f ghi XYbhYj U`i Uh]cbg'cb'j Uf]ci g'UgdYWg'cZh\Y'Wci fgY'UfY'[fUXYX/h\Y'7 ci fgY'7 ccfX]bUhcf'dfYdUfYg'U gi a a UfmfYdcfhZcf'h\Y'<YUX'cZGW\cc`":5bmdfcV'Ya 'UfYUg'UfY']XYbh]ZJYX'Zcf'fYa YX]U``UW]cbž'UbX']XYUg Zcf'a U\_]b[ ']a dfcj Ya Ybhg'hc'h\Y'Wci fgY'UfY'bchYX'Zcf'UW]cb'h\Y'bYI hha Y'h\Uhh\Y'Wci fgY']g'fi b'': cW g ; fci d'A YYh]b[ g'UfY'WcbXi WhX'Vmh\Y'Zci f!NYUf'A UbU[ Yfg'fUWUXYa ]WghUZŁ'Zcf'Ubmghi XYbhg'k \c'k ]g\'hc UhYbXž]b'YUW\'mYUf'cZh\Y'W]j ]``UbX#cf'Ybj ]fcba YbHJ`Yb[]bYYf]b[ 'dfc[ fUa g"'Ghi XYbhWca a Ybhg'cb'YUW\ Wci fgY'UfY'Wc``YWhYX'UbX'X]ggYa ]bUhYX'hc'h\Y'@YWi fYfg'WcbWffbYXž'bch]b[ 'Ubmdc]bhg'k \]W\'WUb`\Y`d ]a dfcj Y'h\Y'Wci fgY"

## 5WUXYa]W=bZcfaUh]cb

: ]bU``9I Ua ]bUh]cbg.

: ]bU``YI Ua g`]b`H%&\$&&`k ]```VY`\Y`X`cb`]bY`VYIk YYb`&-I\`5df]``!`%&I\`A Um`]bWi g]j Yž'UbX`gi dd`Ya YbIUfm YI Ua g`VYIk YYb`&' fX`!`&+I\`A Um`]bWi g]j Y"`Nci `UfY`fYei ]fYX`Ic`VY`Uj U]`UV`Y`cb`I\YgY`XUIYg"`D`YUgY`Xc

# 5ddYbX]I. '9b[]bYYfg'5ighfU`]U'f195ŁDfcZYgg]cbU`'9b[]bYYf'7cadYhYbWm GHJbXUfX

Dfc[fUa +bhybXYX @YUfb]b[ Cihwca Yq ? bck `YX[ Y 'UbX'q\_]``'VUqY D9%"%7cadfY\Ybq]iYžh\YcfmVUqYXibXYfqHUbX]b[cZh\YibXYfd]bb]b[bUhifU`UbX d/mg]WU`:gW]YbWYg`UbX`h\Y`Yb[]bYYf]b[`Z bXUa YbHU`g`Udd`]WUV`Y`hc`h\Y`Yb[]bYYf]b[`X]gW]d`]bY D9%"& 7 cbW/dhiU`i bXYfqHUbX]b[ cZh\Y`a Uh\Ya Uh\Wažbi a Yf]WU`UbU`mg]qžqHUh|qh\WažUbX Weadi hYf'UbX']bZcfaUh]cb'gW]YbWYg'k\]WX'i bXYfd]b'h\Y'Yb[]bYYf]b['X]gW[d`]bY D9%" + + XYdh i bXYfqHbX]b[ cZqdYWU`]qhVcX]YqcZ bck YX[Yk]h bhY'Yb[]bYYf]b[ X]qWd`]bY D9%"('8]qWFfba YbhcZ\_bck YX[YXY]Ycda YbhUbXfYqYUfWXX]fYWfcbg'k ]h.jb'h.Y Yb[]bYYf]b[`X]gWJd`]bY D9%") ? bck `YX[Y`cZYb[]bYYf]b[ `XYg][b`dfUW]WY`UbX`WcbhYl hi U``ZJW/cfg`]a dUWf]b[ `h\Y Yb[]bYYf]b['X]qW[d`]bY D9%"\* I bXYfqHJbX]b[ cZh\Y'qWcdYždf]bW]dYgžbcfa gžUWVci bHJV]]]h]Yg'UbX'Vci bXg'cZ qi qHU]bUV`Y`Yb[]bYYf]b[`dfUWf\WY`]b`H\Y`qdYW[Z]WX]qW[d`]bY 9b[]bYYf]b['Udd`]WUhcb'UV]`]hm D9&"%5dd`]WUhjcb`cZYghUV`]g\YX'Yb[]bYYf]b[`a Yh\cXg`hc`Wca d`YI 'Yb[]bYYf]b[`dfcV`Ya qc`i]b[ D9&"&: `i YbhUdd`]WUhcb'cZYb[]bYYf]b[ 'hYWkb]ei Ygžhcc`g'UbX'fYgci fWfg D9&"' 5dd`]WUhjcb'cZgmghYa UhjWYb[]bYYf]b['gmbh\Yg]g'UbX'XYg][b'dfcWYggYg D9&"( '5dd`]WUHcb'cZgmghYa UHWUddfcUWXYg'hc'h\Y'WcbXi WiUbX'a UbU[Ya YbhcZYb[]bYYf]b[ dfc Y₩q DfcZYgg]cbU`UbX dYfgcbU`Uhf]Vi hYg D9' "%'9h\]WU``WcbXi WiUbX'dfcZygg]cbU``UVWci bHUV]`]hm D9' "&'9ZYW) Y'cfU`'UbX'k f)HYb'Wca a i b)WU) cb']b'dfcZygq]cbU`'UbX'`UmXca U]bg D9' "' 7 fYUhi Yžibbci Uhi YUbX dfc!UWi YXYa YUbci f D9' "( 'DfcZygg]cbU``i gY'UbX'a UbU[ Ya YbhcZ]bZcfa Uhcb D9' ") CfXYfma UbU[Ya YbhcZgYZzUbX dfcZygq]cbU`WcbXi Wh D9' "\* 9ZYWAJ Y HYUa 'a Ya VYfg\]d UbX HYUa 'YUXYfg\]d