

Densidade lexical em textos gerados pelo ChatGPT: implicações da inteligência artificial para a escrita em línguas adicionais

Lexical density in texts generated by ChatGPT: implications of artificial intelligence for writing in additional languages

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Resumo

O avanço tecnológico tem tido um grande impacto na produção escrita, especialmente em Línguas Adicionais (LAs). Embora a tecnologia tenha trazido novas oportunidades para o ensino de LAs, ela também apresenta desafios, incluindo preocupações sobre a complexidade da escrita e a autenticidade dos trabalhos dos alunos. Uma dessas ferramentas é o ChatGPT, plataforma de inteligência artificial (IA) que tem sido objeto de debates desde sua popularização em 2022. Este estudo analisa um corpus composto por seis tarefas produzidas pelo ChatGPT em cinco idiomas (alemão, espanhol, francês, italiano e português), considerando os níveis de proficiência propostos pelo Quadro Comum Europeu de Referência para Línguas (CEFR), que totalizou 2991 textos e 706,401 palavras. Os dados foram gerados por alunos em um laboratório de informática em uma universidade britânica a partir de 100 diferentes perfis na plataforma do ChatGPT, seguindo instruções dos pesquisadores. A análise dos dados utiliza a linguística sistêmico-funcional (LSF) e o conceito de densidade lexical (Halliday, 1985, 1987, 1993; Halliday; Matthiessen, 2014) para investigar a complexidade dos textos produzidos, dado que a complexidade lexical está relacionada à proficiência na escrita, na qual textos mais avançados usam proporcionalmente mais “palavras de conteúdo” (nomes, verbos, adjetivos e alguns advérbios de modo). Os resultados revelam que o ChatGPT não segue as instruções das tarefas quanto ao número de palavras solicitadas, impactando, assim, no cálculo da densidade lexical, nem produz textos que mostram diferenças significativas da densidade lexical entre as línguas adicionais e níveis de proficiência.

Palavras-chave: Línguas adicionais. ChatGPT. Inteligência Artificial. Linguística Sistêmico-funcional. Densidade lexical.

Abstract

Technological advancement has had a significant impact on written production, especially in Additional Languages (ALs). Although technology has brought new opportunities for AL teaching, it also poses challenges, including concerns about the complexity of writing and the authenticity of students' work. One such tool is ChatGPT, an artificial intelligence (AI) platform that has been the subject of debate since its popularization in 2022. This study analyses a corpus consisting of six tasks produced by ChatGPT in five languages (German, Spanish, French, Italian, and Portuguese), considering the proficiency levels proposed by the Common European Framework of Reference for Languages (CEFR), totalling 2991 texts and 706,401 words. The data were generated by students in a computer lab at a British university from 100 different profiles on the ChatGPT platform, following the researchers' instructions. Data analysis employs Systemic Functional Linguistics (SFL) and the concept of lexical density (Halliday, 1985, 1987, 1993; Halliday; Matthiessen, 2014) to investigate the complexity of the produced texts, as lexical complexity is related to proficiency in writing, where more advanced texts proportionally use more “content words” (nouns, verbs, adjectives, and some adverbs of manner). The results reveal that ChatGPT does not adhere to task instructions regarding the requested word count, thereby impacting the calculation of lexical density, nor does it produce texts that show significant differences in lexical density among additional languages and proficiency levels.

Keywords: Additional languages. ChatGPT. Artificial Intelligence. Systemic Functional Linguistics. Lexical density.

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1 Introdução

dC's-q- qYéx b C'zqf- SzOL ^S -qS <S YFR gC- eq@-éx b G<qf- C\ YL--s- @SS^ -S fX sg
~\ @G- " b eCb <b^U^zh @ f- fCS= - zG^bYLS C'fbYs> b epde sSb \ bzsf @bqCbqfC'z @bq@
G<qf- Cb ^ fCY@<b^PG-S C'zb @C~\ - YL-- l-Cb zCz b LCq @b ebqR - eqsC'z i Bss- s f- fCS
S e- <z \ b zCz b G<qf b C\ zCq bs @Cs-- @'sS@ @CYfS- YebqsCq~\ S@S- @bq @ <b\ eYfS@ @
@ G<qf- fO- Y@%oc_DI>c_DI>c_DI>c_{t; bY\ 4S | @EE | -qSs> | @Eug @s @HqC^é s C'zqf
bq Y@ @CCG<qf- fO- Y@%oc_DI> | @EEt TbP ^ssb^> | @EEt Kb^<-Y- GGq^~^@> | @EDg @ YL-- LC
<S^z" <- fO- Y@%oc_{t | bbPCz z C- Y | @EIt pS bt as~^t X Lbs> | @E t] - ssGf yPb\ esb^>
| @Ecg @ ep" <S^<S YL- szS- C\ ~\ - YL-- - @SS^ - Yfvb^@ Y | @EIt] - Yssb> | @ED r<P^~q
p-4s> | @Ecg C @ H-S@ @C^ - YS- q l-C~\ zCz b eb@C- eqsC'z qfVC 4 q't, s.: ^S | @E | g
, @'sS@ @CYfS- YqHqCqC Â ebqC'z LC @C S' s YfS- S C\ ~\ zCz b S Hqf b eCb <-Y- Y @
e- Yfq s @C <b^zC @b fs-4sz ^zYbs>- @CzYbs C fCqbs C- Y-^s - @f qfSs @C \ b@bg C qYéx A
zbz- Y@ @C e- Yfq s eqsC'z s ^b zCz b f) q>c_ucg

Bsz-@s qY-S^ -@s Â @'sS@ @CYfS- Y@z \ @CY^L @z f) q>c_uct O- Y@%oc_DI t TbP ^sQ
sb^> | @EEt pG @ | @Eg <b\ ~SS- éx b @C <bqpbq e- q H- Cq - ^- YS G l ~ ^zS- zS- s ebq \ Cb @
eqLq \ -s <b\ e-z <S^ -S fyCz, ^- Y@q yCz Y@q p, | KB f | -z^> | @E { g XCSbbY | S qsbH
„ bq@a ^Y C} zS%y, , XB? >d%pb^>B/ r drr>zq | B>ebqCt C eYg dbq \ >^x b P-Gsz-@s l-C
S fCSZ-L ~\ <bq-s qS-Y ^zC@-zS@ @Cs ep@- @s eCb; P-zkdy fyq ^shq \ @bqKC'G zYb
dq q qS- @bg <b\ @ @s C @HqC'z s YL--s- @SS^ - Si

, <q <CqS- ep@- Y@; P-zkdy - LCq éx b @C Lq ^@s l ~ ^z@ @s @ @ @s b- zCz b s
fSzb zCq- ebsS@ @C LCq @s - e qf @C eCqL^z s b- z qHs l-C YC s b sbYs @ s-H- C' @
-UszG> <bqf é G>S<Ysxb @C e- Yfq s C-s ^@ @Cq S- @b L ^Cq zCz- Yb- Hq \ -zb q l -Cqf b
@C- <bq b <b\ -s Ssq-é G Ssq@ s ebqP~\ - ^bs fV~\ - q | @E { t V- s^C-S C- Y | @E { g yq z @C @
~\ q<-qb @CR l-C ebsS@ - S zCq éx b <b\ b ~s- @b e- q l-C- e qf @C Ssq-é G> ep@- <
zCz b G<qf b s C CP ^zC- b l ~CsGf ep@- @s ebqP~\ - ^bs fdCqM> | @E { t VS Lt; P-zkdy > | @E { t
pbseLYbs | @E { t , ^@Cp^ C- Y | @E { g } \ @s -seCzbs ebsS@ @C - <bq b <b\ [S qfS
, ^@pbYzSC, %b-4f | @E { g Cp- \ bs f | @E { g l-C- Hq \ C'z zC@- ep@- S qzCzbs <b\ qLszp
G<qf b \ -S Hq \ -Y@ @b b ~sb @ fb< 4-Y@b \ C'bs <bYl -SY

B^zCz ^zb- eG-s q@ - e q'zCH-S@ @CbHqC-S@ eCb; P-zkdy <b\ qYéx b Â G<qf >-s qsebsQ
z-s eb@C - eqsC'z qzCzbs s C <bCq ^S s C a^zS- fdCqM> | @E { t ?- Y | @Ecg 4 S- @YqS@ @
CYfS- YfKCPq \ ^t r zq4Cyt p-sP> | @E g fb< 4-Y@b qeCz b f? Cp- <PC> | @Ect Gq P'S Lt S-4S L- >
| @Ecg C S Hq \ -é G eb- <b <b^" -fCS> <b\ HY @C C C eYs q S fV~\ - q | @E { g

] x b P-> ^b C'z ^zb> Gsz-@s l-C S fCSZ-L C b H^<S^~\ C'zb @; P-zkdy C\ zCq bs @C qS Q
ebsz s b- zCz b LCq @s l ~ ^@b sxb Ssq@ s -s \ G\ -s z qHs C @HqC'z s YL--s- @SS^ - S
~s- @s S zbs> Ssq-é G GseG- " <s qHqC'z s -bs ^ fCS @C ep" <S^<S @b k ~ @p; b\ ~\ B-Q
qpeC @CpCq ^S e- q X^L--s f; BGpgi; b^sCq ^@b Gs- Y<~^> GzC- qS b 4-s<- qseb^@CqÂs
sL-Sz s eCqL^z s @CeG l ~S- =

-i b; P-zkdy ep@- @ @s sL-S@b -s Ssq-é G ^b l-C @ qseCb - b ^ \ Cq @C e- Yfq s
sbYs @ s e- q -s @HqC'z s YL--s- @SS^ - S C^ fCS @C ep" <S^<S m

4i b; P-zkdy ep@- @ @s l-C qfCY \ @'sS@ @CYfS- Y@Ssz C'zqf-s YL--s- @SS^ - S Cbs
^ fCS @C ep" <S^<S m

<i b; P-zkdy ep@- @ @s l-C qfCY \ @'sS@ @CYfS- Y@Ssz C\ ~\ - \ G\ - YL--> <b^sCQ
q ^@b bs ^ fCS @C ep" <S^<S m

@ b; P-zkdy ep@- @ @s l-C @ b^sq \ <bqYéx b C'zqf- @'sS@ @CYfS- YC- C'zC'sxb
zCz- YC < @ ^ fCY@C ep" <S^<S m

d-q z ^zb> GszCsz-@b zC <b\ b b4Cz b <b\ eqC^@q- @'sS@ @CYfS- YC\ zCzbs ep@- @s
eCb; P-zkdy C- ^- Y- q- <bqYéx b @s- @'sS@ @C ^-s YL--s- @SS^ - S C^bs ^ fCS @C ep" <S Q
^<S eqfS zbs ^-s z qHs i , s <b^zqf-S G @szC Gsz-@b zq <C\ S@S- é G sb4q GseC-S @ @s ^
^-z-qf- @C zCzbs l-C b; P-zkdy ep@- ^-s YL--s C qseC-zYbs ^ fCS @C ep" <S^<S>- Y \ @
S Hq \ -é G S ebq ^zG sb4q b ~sb @G- Hq \ C'z @CR ^- ep@- éx b @C zCzbs C^ - eqpebs@b

1 Fonte: <https://www.britishcouncil.org.br/quadro-comum-europeu-de-referencia-para-linguas-cefr>. Acesso em: 03 jul. 2023.

@Cz qHs @CGs<fz ^b C^sS^b @CYL--s - @SS^ - Si

BszC-qfLb Gz-bqf- ^S- @b C <S^b scE Gs>S<Y @ Gz Szp@-éxb>- Y\ @s qffq ^<Ss C~\ - ^Cfb <b\ -s z qHs -eY- @s e-q - LCq éxb @ @ @bsi , sCL~^@ scÉb -4bq@ b <b^<CSb @ @^s@ @CYfS- Y- zCqCq @G<fCb @G^Pb @b Gz- @b C @Cz- P- - ^-z- qf- @bs @ @bst - l-- qf- sSzC - zS- bs @ @bs>- ^- Y- ^@bQs C @Gz<- ^@b <bqfYé Gs C <bC <S^zS G ^- Y C^zC- l~Sz qfebqz bs qS- Y- @bs LCq S C <b^zqf- S Gsi

2 Densidade lexical

, @^s@ @CYfS- Y@ qseCSb ÂebqC^z LC @ SC^s YfS- S C ~\ zCfb>SfHq@ eCb <Y~Y @ e-Yfq s @ <b^zC @b fs-4sz ^zfb>- @Czfb> fCqfbs C- Y~^s- @f qfbs @C\ b @bg C qYéxb Âz z Y@ @C e-Yfq s eqsC^zS ^b zCfb f} q>c_uct } qf BYs>c_uit O- Y@%c_Dl>c_{g BssC <b^<CSb ~\ S @z- zfb @C@G^fbYfS C^z C <b\ eYf@ @C @ G<fz >@Hq^é s C^zC bq Y@ @C G<fz > YL- LC <C^z" <- fO- Y@%c_{g C edp" <S^<S YL- szS- fO- Y@%c_Dl>c_{>c_Dt ; bY\ 4S | @fHq

, S fGzL- éxb @ @^s@ @CYfS- Y @C - <bq@ <b\ TbP- ^ssb^ f | @fHq zC\ sSb bqC^z- @ ebq @Hq^zS eCpeC-zf- s f} q>c_uct } qf BYs>c_uit O- Y@%c_Dl>c_{g , eCpeC-zf- @ } qf fc_ucg eY @S^S éxb C^zC e-Yfq s l-Cz \ epeq@ @G YfS- S fzCq bs Lq \ -zS- S b- l-C ebss-C ~\ - H^éxb sSz-zS- Qq \ -zS- Y @ l-CYs l-C ^xb ebss-C z Yedpeq@ @C , ssS > b ^ \ Cqz z Y@C e-Yfq s <b\ epeq@ @G YfS- S > YfS@ eCb ^ \ Cqz z Y@C e-Yfq s bqblq" <-s> @ ^Cb <b^<CSb @ @^s@ @CYfS- Ye-q GsC- ~zq O- Y@%fc_Dl>ei vlgS-LqCl -C- s \ @ @ s sC qY<S^~\ -bs e- @q Gs @C@szpL- S Gs @C e-Yfq s C @Hq^zS zébs @CzCzbs HY@bs CGs<qfbs i , \ @ l-C <q <Cqf- - @^s@ @CYfS- Y- Y- b- 4 S- Gz-z \ 4 \ YL- @ - b Hz b @C b zCfb sCqHY@b b- Gs<qfbi , S@ @C - <bq@ <b\ O- Y@%fc_Dl>ei Dq- \ @ zeS- @b SLYs HY@ Gz- C^zC C | C | > C l ~ ^z b b f Yqe-q b Gs<qb" <- C^zC { C v> @C e C^@ @b @ l-xb Hq- Y - G<fz- C @Gz <- l-Ceb@CP- fCqf- qé Gs @C - <bq@ <b\ bs <fz qbs- @bz @bsi rb4 Gs- eCpeC-zf- > TbP- ^ssb^ f | @fHq -s- bs sCL-SzS ebqC^z- S- e-q zCzbs HY@bs> @^s@ @CYfS- YSfHq- JCh C e-q zCzbs Gs<qfbs> @^s@ @CYfS- Y @C JCh b- \ - Si

} qf C BYs fc_uug -" q- \ l-C zq @SS^ - Y C^zC s-4sz ^zfb> fCqfbs C- @Czfb> sxb -s zq s <YssG @C e-Yfq s <b\ epeq@ @G YfS- Si , GsC qseCSb> TbP- ^ssb^ f | @fHq @Gz <- l-C GsG S C^s sxb <P- \ - @bs @C e-Yfq s @ <b^zC @b ebq- eqsC^z q\ - ebssSfS@ @C @S^Ysxb @C^b fbs S C^s> @Hq^zC @s <YssG HCP- @s b- e- qfS \ - S Lq \ -zS- Si

O- Y@%fc_Dl g qz\ - -s @s~ss Gs e-q Gs YqC<Gq- @Hq^é @CH^éxb @C~\ S C YfS- YC @C~\ S C Lq \ -zS- Y fSzb l-C~\ S C eb@C sC <b^szS- S jebq \ - S @C~\ - e-Yfq >- C C eY @C fCqfbs - ~fS qS C \ b @ Si TbP- ^ssb^ f | @fHq C e Y S- Gs- s @Hq^é s- b @Gz <- qf

} \ S C YfS- Y @ ^S@ ebq O- Y@%ab\ b ~\ S C l-C H^<S^ - C <b^U^zbs YfS- S C^xb C \ sSzC -s Lq \ -zS- S- Szb > C C S C^zq \ C <b^zq szS- 4Cqbs C^xb HCP- @bs fO- Y@%c_Dl = v{g a S C YfS- YH e- qfC @C~\ <b^U^z b - 4Cqz > l-C eb@C sCq <b^zq sz- @ <b\ f- qbs S C^s @ \ ~^@bi } \ S C Lq \ -zS- Y ebq b-zp Y @ > C^zq C ~\ sSzC - HCP- @ > @C - <bq@ <b\ O- Y@%f TbP- ^ssb^ > | @fHq ei vvg

a H^@ \ C^z @ fSxb @ O- Y@%fc_Dl g -@f \ @C s- <b\ eqC^sxb @b @G^fbYfS C^z @ YL- LC i | b S^ S @b @G^fbYfS C^z YL- szSb>- s <b^szq-é Gs bq <S^ - S @s <f ^é s sC <b^sQ zS- C C ~\ <b^zS ~\ > eqeb^@Cq ^@b s-4sz ^zfb> fCqfbs C- @Czfb> GzG S C^zS <- @bs <b\ b S C^s YfS- Si

B\ c_{^2} > O- Y@%b4sCqf- l-C- @^s@ @CYfS- Y ~\ - \ @ @ YL- @ Â @^s@ @C S Hq \ - éxb @C l ~ Y-Cq zCz C C zq\ bs @ S C^s YfS- S fe-Yfq s @ <b^zC @b C qYéxb Âs e-Yfq s Lq \ -zS- S g eqsC^zS ^- Gzq-z-q Lq \ -zS- YC \ @ @ eCb ^ \ Cq @C e-Yfq s YfS- S C <- @ bq éxi , @^s@ @C S Hq \ - éxb qeqS C^z - ^béxb @C C e- <bz \ C^z > fSzb l-C~\ zCfb <b\ - Y- epebqxb @C e-Yfq s @ <b^zC @b <b^z \ \ - S S Hq \ - éxb @b l-C~\ zCfb <b\ - Y- epebqxb

² Neste estudo, o foco de Halliday é o texto científico e suas características em termos de: definições entrelaçadas; taxonomias/classificações técnicas, expressões/termos específicos, densidade lexical, ambiguidade sintática, metáfora gramática e descontinuidade semântica (Halliday, 1993, p. 78).

@@e-Yfq s H^<S^> S feqebss G>S zCqG G>ep^b\ G>ch^U^é G Ce-Yfq s <h^z-fCSg , S@
e-q O- Y@%fc_{g-Gs- l~ ^z@ @eb@C f-q q4 sz ^zC@C bq éxb e-q bq éxb\ -s-s Y^z l-C
ebss fCY fCf <q-\ - z^@^S @C-\ <h^z~\ C^zq HY C G<fz-i]- G<fz>- YL~ LC
z^@- sG\ -S eY^U@ C Hq -Y- @'s@ @ -Y C <b\ z^@^S @CsGqS^ ^S\ C^z\ -Sq
^ G<fz <@\ S-i B\ <sbs @C@'s@ @C YfS- Y ~Sb -Y >@C-<bqeb <b\ O- Y@%fc_{g-
Ys-q eb@CsG\ -S @Hs^zq^ ^@b b zCz eb-<b S zOL fCY
, @'s@ @C YfS- Yz\ qY éxb <b\ - @YqS@ @C <b\ eYfS@ @C YfS- Y@C fb< 4-Yeb f| - qS^s
| @ut Kb^<Y Gq^<@ >| @Et pS bt a s^<t X Lbs| @E_gC- @YqS@ @C YfS- Y Hq -C^z\ C^z
~s-@ <b\ b ~\ C ~Sf Y^z C^z ^q -G- YfS- YfTbP^ ^ssb^>| @Eg] b C^z ^z^ ^GzC-qdL> b Hb
^ @'s@ @C YfS- Ye-q C^z^@q- <b\ eYfS@ @C G<fz ep@<S eCb; P-zKdyi , ssS >-
sL-Sj- eqsC^z @Cb @C^Pb @CzCsz-@l -C<b^z\ eY @ @s l~ ^z^ zfs- qseCb @ @'s@ @
YfS- YCs- <bqY éxb C^zq Y^L~ s- @S^> S C^ fCS @Cep^ <S^> Si

3 Desenho do estudo

] GzC Gz-@>- Lq éxb @s @ @s>bs ep<@S C^zbs z <^Sbs C- - 4bq@ LC \ - ^- Yz- @Cs- s S Hq
\ - é G <q <Cf- \ @Cebq-\ - eG l~S- l~ ^z^ zsf f? q^%S | @Eg fSzb eqbq-q-\ - \ bszq
Lq ^@C@ @ @s>eGq S^@b H<Gq- Y-\ - s LC^q Y- é G @ @'s@ @C YfS- Y@bs zCzbs ep@<Sbs
^<s @Hq^zG Y^L~ s C- ssb^S @bs -bs ^ fCS @Cep^ <S^> S eqfSzb eCb; BGpi BzC-qdLz \ 4 \
sC l~ Y< <b\ b CteYqz qb C @G<fzbt CteYqz qb> eq -C b fbY\ C @ @ @s @s @Hq^zG
Y^L~ s C @bs qseCzfs ^ fCS @Cep^ <S^> S eqfSzb C <@ ~\ - @s -zfs@ @s eqebqS^<
\ - SqH\ S q@ @ <b\ - s b-bq ^<S s @C@'s@ @C YfS- Y @G<fz>ebq ~CeGq S C @C<fCqS- s
<q <CqzS- s C Gz 4C Cqebss fCS <bqY é G C^zq- s f-q fCS fKS | @Eg

a s e- qS^> ^zG @CzC Gz-@b sxb Gz-@ ^zG @C-\ - ^YqS@ @ 4q^>S- l~C sC @se-sG\ -
e- qS^> q@ eG l~S- e- qS^> @C-\ - ^ ^<S fCS-Y@ ^<seYz Hq -s fS^> S @ eq eq ^YqS@ @C
C CQ- S eGsb Si] b qHqeb - ^ ^<S> <h^z f b YW@C- <Gsb - b Hq -Yeb f| S qsbH Gq sg
e-q l~Cbs S zCfss @bs e-@ss\ b4CqS Hq - é G- qseCb @ eG l~S- > <h^z^@b @z P-\ C^z
@bs b4Czfs C- ^<z-q- @ e- qS^> éxb fb l~C P G Cq C^Ssb H<Gq Y^L~ s- @S^> S l~C-
eG l~S- <h^z\ eY f> <h^z^> C^z SSS Y@; P-zKdyt l~ ^@> b^@C eq Q 4bq- q-Cq ebq
s- e- qS^> éxb @C @- s Pq s ^b Y4bqz qb @C S Hq -z- g a s S zCfss @bs C^zxb eqC^<PS \
b Hq ~Yeb> @ f\ <S^> S @ @z C l~C- z qH @Cqf sG q G Y- @ C- ss^> f\ b zq b @C
<b\ ep\ Ssb @ z- ^- eG l~S-³i

; b^sCq ^@b l~C- eG l~S- S<Y- z qHs C <S<b Y^L~ s- @S^> S f- Y\ xb> Ge ^PbY Hq ^Q
< s> S Y^<b Cebq-L~ sg eY^U@s @C-<bqeb <b\ bs ^ fCS @Cep^ <S^> S eqfSzb eCb; BGp> bs
e- qS^> ^zG sC<S^> @bs Hs sb YS- @ s eYs\ C^zC l~C <beS ss\ - s Sszq- é G @ <@ ~\ - @s
sCS z qHs eqfS\ C^zC Y4bq @s eCbs eG l~S- @qS>C \ @s <S<b Ssb\ - s @ <@ fG>C- s
SsCfss\ ^ eYz Hq - R fa , ^Cb , \ bszq - s z qHs C ebq-L~ sg B\ sL~> <beS f\ -
qsebsz ep@<S eCb; P-zKdy e-q <@ z qH C- SsCf\ C \ Hq ~Yeb f| S qsbH Gq sg
GseC^> <b- b Ssb\ - i , b ^<Y <b\ eYz q\ <S<b Hq ~Yeb <b\ sCS zCzbs <@ ~\ > qseCzsf Q
\ C^z , s z qHs Hq \ ep@<S s- e- qS^> @C @E^> z s @Hq^zG ^b; P-zKdy C- <b\ e- ^P- @s
ebq eCb \ C^bs> \ @bs eG l~S- @qS C H^<éxb @s GseC^> <S @ @s -zfs@ @s C C fS^> @C
ebss fCS @ fS^> s l~C e-@ss\ s-qSjC @s @S<~> @C <b\ - Hq \ C^z @C R t b zC eb \ - fS b
e-q - q Y- éxb @s -zfs@ @s Cq @C @- s Pq si B\ Lq Y- eYz Hq - H^<S^> b- sC eq4Y \ ->
C- C<Céxb HsC ^b fC< sbs ^bs l~S ^> b Hs ebs fCY <b\ eYz q- z qH S @S^> - Y C^z> sC^@
GzG zCzbs C<Y @bs B^zqz ^z> - \ - qC @C ep4Y \ - s Hs 4 sz ^z 4 S- > C @bs { @EzCzbs
GseCq @bs | _c f_ iuh g Hq \ <b^<Y @bs <b\ s- <Gsb C Hq \ - \ b <bq- s @CzC Gz-@> <h^z Hq C-
y- 4Y ci

dbqz ^z> ^- y- 4Y c fCf <b- qC b ^ \ Gp @C zCzbs - e s bs sL~S zG - UszG= e-q - X^L~
, Y\ > @bs zCzbs Hq \ C<Y @bs> \ @C Ssb - b Hz @ zCq <beS @ - -zfs@ @ ^<b S^> @ C
b-zp ebq zCq - @S^> @ - eC^> s- s Sszq- é Gt e-q - X^L~ Bse ^PbY> C zq s zCzbs> sb\ C^z
Hq \ <beS @s - s Sszq- é G e-q - -zfs@ @ e-q - X^L~ B Y ^> - \ zCz <h^z S P- - eC^> s- s
Sszq- é G> sC CP ^zC- b l~C b <bqC- <b\ @bs zCzbs C X^L~ dbqz-L-Gs i

³ Processo enviado ao comitê de ética na pesquisa da Universidade de Essex, número ETH2223-0987.

Tabela 1. Número de textos por línguas, distribuídos por níveis do CEFR.

	fCY, c	fCY,	fCY3c	fCY3	fCY; c	fCY;	yz Y
, Y\ xb	cCE	cCE	cCE	cCE	—	—	I_D
Bse- ^PbY	_D	cCE	cCE	—	—	cCE	I_v
Gq ^< s	cCE	cCE	cCE	cCE	cCE	cCE	vCE
B- Y ^b	cCE	cCE	cCE	cCE	cCE	—	I_
dbqz-L~ s	cCE	cCE	cCE	_D	cCE	cCE	I_D

Fonte: Os autores.

d-q - - ^-SC @bs @ @bs>bs <qz qbs Hh\ bql- ^S- @bs @C- <bq@b <b\ - s eCq- ^z- s @CeGl ~S- CC<- @s ^- Szp@-é-b @SzC - qSb C -\ <b^U^zb @C Hh\ C^z- s HhS -zSS- @= bs zCzbs @bs Hh\ ~Yqbs fl SqbsH Gb\ sg <b\ eYz- @bs eCb s e- qSS- ^zS @b Sz- @b Hh\ SSS Y C^zC4 S- @bs ^b Hh\ - zb @CeY^SP- s @CB<CYCbs zCzbs Hh\ eCq- q @bs f Y ebs g\ - ^~ Y C^zCe- q - - ^-SC> ~s- ^@b b Hh\ - zb; r, ^b B<CY B\ sL- S@ >< @ - q ~Sf> bql- ^S- @b ebq YL~ Cebq ^ fCY HhS s-4 Czsb - ~\ - - ^-SC YC s- Y~s ^@b b eplq \ - d%pb^ ebq \ Cb @bs -\ 4C^zS @C C<G-é-b KbbLY; bY4bq zbq%fc Hh\ ^b\ - Y C^zC <b\ b; bY4gCT-e%Gq ^bzCbbWCB; P-zKdyi dbq" \ > bs @ @bs U- bql- ^S- @bs C <YssS <- @bs Hh\ zq ^sebszbs \ - ^~ Y C^zCe- q eY^SP- s ^b B<CYC s-4 Czsb - b zqz \ C^z- ^- Yzsb <b\ ~sb @CHq \ -Ys e- q - ^-SC @ @ @bs ^b eq eqb B<CYC ^b sbH. : qCrdrr e- q - ^-SC Sz- zsz- i

4 Apresentação dos dados e análise dos resultados

as zCzbs Lq @bs eCb ; P-zKdy qS- Y q \ C \ ^ \ Cq sL^S <- zfb @Ce- Yfq s > <b^sCq ^@b - s f- q fCS= YL~ - @SS^ -YC ^ fCY @C ep" <S^<S @C- <bq@b <b\ b; BGpi d-q " ^s @C- ^-SC b eqS Cq e- sss HhS H<Gq ~\ - fCqS <- éxb @z- P- @ e- q q- Y- q ~\ - Y eG- @bs @ @bs fr <P^~q p-4b> | Cfcg> s^ @ C<Y @bs zC<Pbs @CSzq-éxb b- S Hh\ - é G qeCz@ si

, Szb l-C b ^ \ Cq @Ce- Yfq s ~\ @bs HzbqS eqS <S- S ~s- @bs ^b <-Y- Y @ @C^s@ @C SSS- GC - - ^-SC eY eCq- ^z- @CeGl ~S= b; P-zKdy ep@< zCzbs sL-S @b - s Szq- é G ^b l-C @ qseCb - b ^ \ Cq @Ce- Yfq s sbYSS @s CP- @Hq ^é s C^zC- s YL~ s Cbs ^ fCS @C ep" <S^<Sm B\ zb@s - s z qHs> - s Szq- é G sbYSS f \ - ep@-éxb @b zCzbs eY Hh\ \ C^z > ~s- ^@b ~\ ^ \ Cq \ ^S bC \ - fS b @Ce- Yfq si , s GL- q s c - v zq \ C Gs- s b <bq ^<S s C \ <- @ ~\ - @s YL~ s C ^ fCS @C ep" <S^<S > qseCzSf \ C^z G

as qS- Y @bs \ bsq \ l-C- Hh\ \ C^z @CR ^xbsL-C- sbqC^z é G @sz qHs Cs-Lq \ ~\ - zC^ @ ^<S S fCq - b l-C s C G eCq q @CzCzbs q l-C qbs C \ ^ fCS \ - S - f ^é @bs @C ep" <S^<Si d-q bs ^ fCS SSS S>- Hh\ \ C^z C<@C b ^ \ Cq @Ce- Yfq s sbYSS @s C>S fCq \ C^z > e- q bs ^ fCS " ^- S > ep@< zCzbs <b\ ^ \ Cq @Ce- Yfq s l- \ @b eq/Szbi

, @Hq ^é @C ebeqS ^- Y @ ^b ep@-zb " ^- Y @b zCzbs eb@C sCq \ - S 4C \ fS- Y- @ ^- s y-4CYs | C { s-4sC ~C^zSi , y-4CY | \ bsq l-C b eCqC^z- Y @CzCzbs <b\ ^ \ Cq - <S - @ sbYSS @b sC <b^<C^zq ^bs ^ fCS SSS Si

Tabela 2. Percentual de textos com palavras acima do esperado.

	fCY, c	fCY,	fCY3c	fCY3	fCY; c	fCY;
, Y\ xb	_h	Dh	Dh	uHh	{{h	CE
Bse- ^PbY	_Ih	DIh	_uh	DIh	JIh	{h
Gq ^< s	cCEh	_Dh	_h	_h	v{h	ch
B- Y ^b	_Jh	u{h	D_h	Dh	c_h	CE
dbqz-L~ s	D_h	uvh	_vh	Dvh	ch	CE

Fonte: Os autores.

, zC^ @ ^<S @ Hh\ \ C^z @CR HhS @C ep@< S\ bs zCzbs sbYSS @bs sC \ <b^zC \ eYqz @bs bs

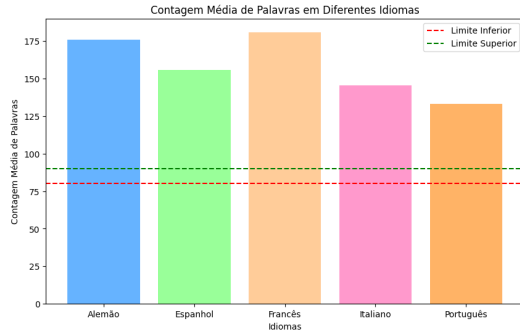


Figura 1. Média de palavras nas línguas e níveis de proficiência: Nível A1.

Fonte: Os autores.

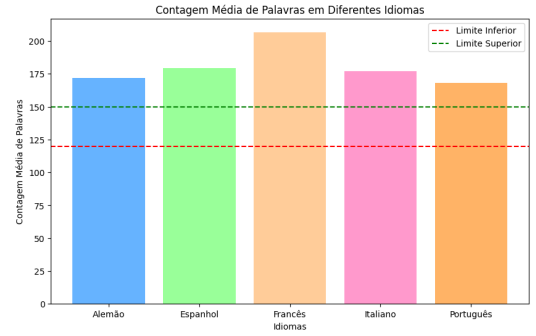


Figura 2. Média de palavras nas línguas e níveis de proficiência: Nível A2.

Fonte: Os autores.

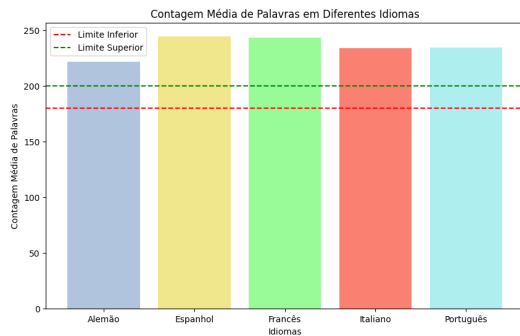


Figura 3. Média de palavras nas línguas e níveis de proficiência: Nível B1.

Fonte: Os autores.

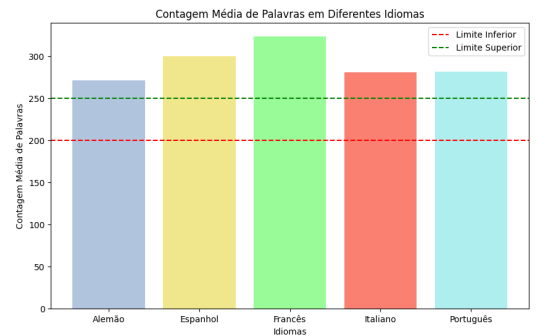


Figura 4. Média de palavras nas línguas e níveis de proficiência: Nível B2.

Fonte: Os autores.

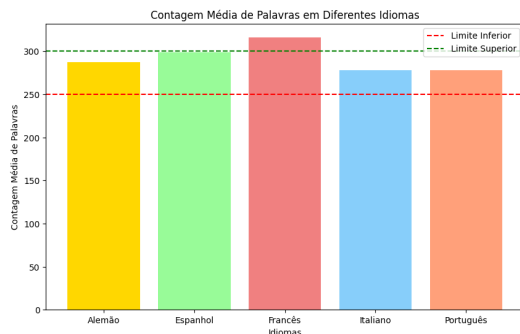


Figura 5. Média de palavras nas línguas e níveis de proficiência: Nível C1.

Fonte: Os autores.

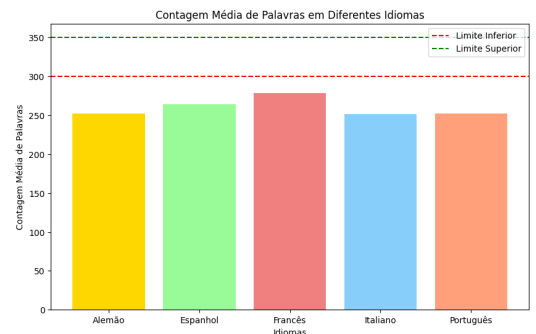


Figura 6. Média de palavras nas línguas e níveis de proficiência: Nível C2.

Fonte: Os autores.

-seCzbs@sS'szq é GsS'sCq@s^bCse-éb eCfSzb\ s~ eYzHhQ -i BssCqS~Y @b qfSg @b^bs @ @bs -eqS^z @bs ^- y-4CY {>b4sCqf^@bQs @Cb-zq eCpeCzsf >b- sU>b ^ \ Cq @Ce-Yfq s -l~ \ @ sbS~ @b sC <b^<C^zq ^bs ^ fCS " ^- Si ; b^" q -QC-ssS >- zC@^S @C^xb sL~Sj zb@s-s S'szq é Gs sbS~ @si

Tabela 3. Percentual de textos com palavras abaixo do esperado.

	fCY; c	fCY;	fCY3c	fCY3	fCY; c	fCY;
, Y\ xb	CE	CE	ch	CE	uh	_vh
Bse-^PbY	h	CE	CE	ch	{h	D h
Gq^<s	CE	CE	CE	CE	CE	u h
B~S^b	ch	{h	ch	CE	cvh	_CE
dbqz-L~ s	CE	ch	CE	CE	c_h	_h

Fonte: Os autores.

a P-^@bs @bs \ bfs C^zbs -eqS^z @bs eCb; P-zKdy <b^U^z \ C^zC @s@Cb eb^zb @C fS~ @b eCq^C^z- Y@C zCzbs <b\ ^ \ Cq @Ce-Yfq s -l~ \ @b GseCq @b C- <S- @b sbS~ @b> qfseC-Q zsf \ C^zC- GL~q u S'szq <Yq \ C^zC GssC ep@-zb zCz- YC qfCY ~ \ \ bfs C^zb S'fCpb> sC <b\ e-q @bs bs ^ fCS SSS S C" ^- Si

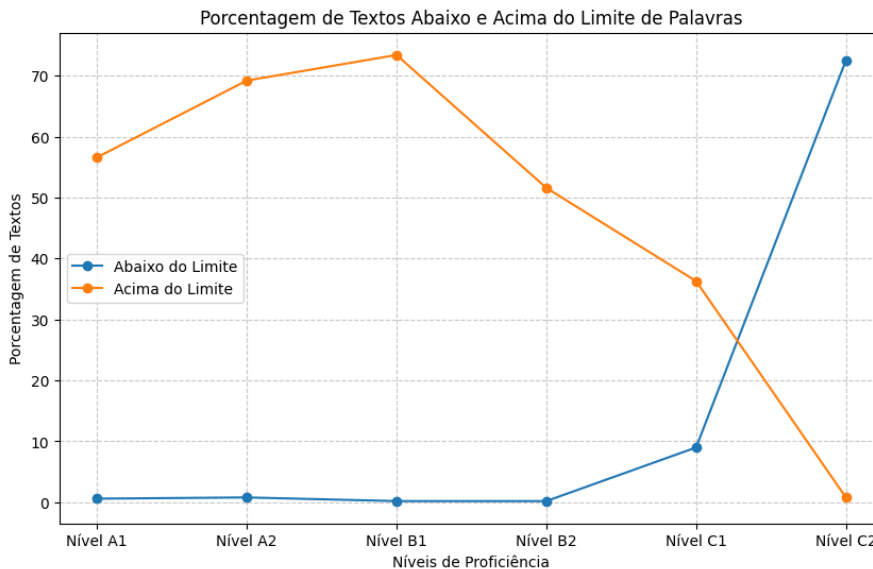


Figura 7. Percentual de textos com número de palavras distinto do esperado

Fonte: Os autores.

; b^sCq ^@bQC-s Y^L--s- @SS^ -S <b^z\ eY@s ^GzCsz @> sCC-S^b-QC-\ - sL~^@ eCq L~^z bQ^z @bq ^- ^-SC @bs @ @bs>l ~ YsU=a ; P-zKdy ep@< @ @bs l-CqfCY \ @C^s @C YfS- Y@S^z C^zq -s Y^L--s- @SS^ -S C^ fCS @Cep" <S^<S m rSz\ -z-s q \ QC bs qS~Y @bs ^- y-4CY Ji

d-q \ CPbqfS~ S-qbs qS~Y @bs \ zq\ bs eCq^C^z- S- GL~q DS'szq GssC<b\ ebqz \ C^zb qfCY @b eCY R ^- ep@-éb G<qz-i

as qS~Y @bs ^- GL~q Ds-LGq\ ~\ - zC@^S sC\ CP^zC^b \ bfs C^zb @ @C^s @C YfS- Y C\ zb@s-s Y^L--s C^ fCSi dbq \ >bs zCzbs @b ^ fCY, | -eqS^z q \ @C^s @C YfS- Y -S -Y @b l-CsC GseCq e-q GzC^ fCY<b^zq q^@b- Sgq z-q @ -q - l~ YS @- l-CGssCeCq^C^z- Y@C @C^s @C qeS^z q - G<qz @C zCzbs \ ^ fCS \ -S -f^é @bs @Cep" <S^<S fKqLbqL^Gt ; YfCY qfS>| CElt; YfCY qfS t dC^b-VQ eC^W| CEcg , C<C^xb HSe-q bs @ @bs ^b -Y\ xb e-q b^ fCY3| >l-C-eqS^z- eCq^C^z- Y- \ eb<b \ -S -Ybi } \ sL~^@b -seCzbs - l-C@ 4q-s< ^b^ fCY3c @b -Y\ xb>S @- ^@b-\ - @Sgq é C^zq-s Y^L--s>CGss- zC@^S sC fCq <- z\ 4 \ C Gse-^PbY Cebqz-L~ si dbqz ^zb>bs qS~Y @bs eCq\ S\ l-CsC- " q CP-fCq @Cq^é s

Tabela 4. Densidade lexical por línguas e níveis.

	fCY, c	fCY,	fCY3c	fCY3	fCY; c	fCY;
, Y\ xb	Jci u	JJicv	{uiw	JIicJ	JCBJ	J{i D
Bse- ^PbY	JDCE	I CBvu	JJiCE	Jvi_c	JJiJI	JuiJI
Gq ^< s	J ivu	JDcD	Jui D	JD{D	J{i D	JDCE
B- Y ^b	Jvilc	J_ilc	J_iJu	J_il{	JiICE	JDuD
dbqz-L~ s	I CD	I Ji{c	JviCE	I CE_v	Juuc	I CB{

Fonte: Os autores.

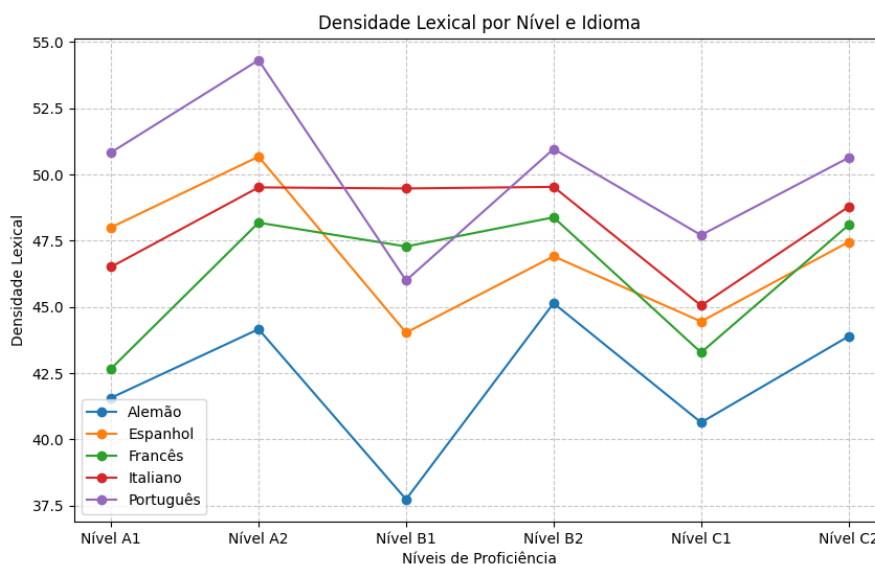


Figura 8. Densidade lexical por nível e idioma.

Fonte: Os autores.

^GssC^ fCYC^zC- s YL~ s> b^HhQ CS@&- @ eCb zCz b LGq @ e-q b ^ fCY3c>C\ 4bq e-q @-s YL~ s P-U ~\ \ b|S C^z b \ -S Gz-fCYC^zC bs ^ fCS, | C3| fS: Y ^b CHq ^< sg dbqb-zp Y@> P~\ - sC\ CP- ^é C^zC- s YL~ s b\ qYéxb - b eGqC^z- Ys-LG@ b l-C- HhQ \ C^z e-qC bez q ebq <Cz- HhQ - Y@ @C @ zCz b G<fbi BssC qS- Y @ b <bq|Abq @ b ^b Gz- @ @C Kb^< -Y GCq ^- @ f| @Dg- l -C- ^- Ysb ~\ <bq- s ~s ^@ \ C^s LC^s G<fz- s ^b y.. SzCq C @sz b- l -C- @^s@ @CYs- Yf- q C ~\ <b^S^~\ C^zC bq Y@ @CCG<fz > s^@b \ -S 4 \$- l ~ ^@ b zCz b ebss-S\ -q- s @C bq Y@ @G

, b b4sGqf-q bs qS- Y @bs C\ ~\ - \ G\ - YL~> b- sCU> sC b ; P-zkdy ep@< @ @bs l-C qfCY\ @^s@ @CYs- Y@szs- C ~\ - \ G\ - YL~ <b^s@q ^@ bs ^ fCS @C ep" <S^<S> bs qS- Y @bs S^szq @bs ^- GL-q Ds-LGq\ P-fCq~\ - @szs^éxb C\ zb@s-s YL~ si rC-b\ e-q@s -s z qHs qYzsf-s-b ^ fCY, c C; |>l~CsC qY-S^~\ -bs ^ fCS @C ep" <S^<S>- CteCz-zf Cq @Cl-CP-fCq ~\ eGqC^z- Y\ -S - Yb ^b; |t ^b C^z ^z> ^xb HhSb l-C sC b^<qSb- ^bs @ @bs Cbs qS- Y @bs b^" q- \ l-C- HhQ \ C^z ^xb <b^sL-CeGqCqGssGs @Cz YCs @b eb^z @ fSz YL~ szsbi

dbq" \ >e-q C^z^Cq\ CPbqbs qS- Y @bs ep<@C-GCÁ- ^- YSbqC^z @ eCY l~q- eCq- ^z @C eGl -S = b ; P-zkdy ep@< @ @bs l-C @ b^szq \ <bqYéxb C^zC- @^s@ @CYs- YC- C^zC^sxb zCz- YC <@ ^ fCYC ep" <S^<S md-q qseb^Cq- Gz eCq- ^z > q-bqf- QC- ~\ - ^- YS Csz-zszs- ~s ^@ b r drri ? Cfsb Â l ~ ^z@ @C @ zCzbs | _c> CÁ ^-z-q- @ - ^- YS CszGs HhQ \ -Lq-e @bs @C <bq@ b\ bs ^ fCS @b; BqP fJ_DzCzbs ^b ^ fCY, c> ICECzbs ^b ^ fCY , |> ICECzbs ^b ^ fCY3c> J_u zCzbs ^b ^ fCY3|> J_D zCzbs ^b ^ fCY; c> CJ_D zCzbs ^b ^ fCY ; |> qseCzsf \ C^zG fS- ^@b - ~\ zqz \ C^z Gz-zszsb \ -S sL^S < zfybi , Pse zSCSSSY l-C- @^s@ @C- ~\ C^z q epqbqS^ - Y C^zC- bs ^ fCS @C ep" <S^<S C- b ^ \ Cq @C e-Yfq si

S ` i MiQ- 7Q` K miBHBx /Qb / /Qb T ` +QMi2KTH ` /m b p `B€p2Bb
T2b[mBb , [m H û /2MbB/ /2 H2tB+ H 2 Q M9K2`Q iQi H /2 T H p` b
7Q` K + H+mH / b TQ` K2BQ /Q mbQ /Q Svi?QM MQb K#B2Mi2b :QQ
TH MBH? b /2 1t+2H Mi2b /2 b2`2K bm#K2iB/ b mK M€HBb2 /2i H
LQ aSaa- /Qi ` K@b2 /m b 7mMïä2b T ` M HBb ` +Q`2H ï½Q
/2MbB/ /2 H2tB+`2H ï½Q #Bp2;B2bb½Q HBM2 b2 bm#/BpB/2 2K [m
/2 M€HBb2, p `B€p2Bb BMb2`B/ bf`2KQpB/ b- `2bmKQ /Q KQ/2HC
`2bmHi /Qb /2`Bp /Qb /2bb M€HBb2 /2i H? / - i` b +Q2}+B2Mi2b
b2`½Q /Bb+miB/Qb b2;mB`, +Q2}+B2Mi2 /2 +Q@p`Hm2V @ hQi H/2S H p
+Q2}+B2Mi2 pi @p`Hm2V @ hQi H/2S H p` #2H2M+ Qb`2bmHi /Qb /Qb i` b
/2 +Q`/Q +QK + / MQp2H /Q *16_X
h #2HX82bmKQ /Qb *Q2}+B2Mi2b TQ` MQp2HX

	*Q2}+B2Mi2 /2`Q`)+B2Mi2 p HQ`*Q2}+B2Mi2 p HQ` /2 i H ï½Q	p Hm2V @ *QMbi Mpi2Hm2V @ hQi H/2S H p
LQp2H R @yX899	l yXyyR	l yXyyR
LQp2H k @yXR9k	l yXyyR	yXyyR
LQp2H "R yXRk9	l yXyyR	yXyye
LQp2H "k yXyRR	l yXyyR	yX3y3
LQp2H *R @yXRdN	l yXyyR	l yXyyR
LQp2H *k @yXyjN	l yXyyR	yXj3N

6QMi2, b miQ`2bX

Pb p HQ`2b b½Q i K#ûK pBbmKHBx /Qb M 6B;m`
Pb `2bmHi /Qb /Qb +Q2}+B2Mi2b 2K + / MQp2H T2`KBi2K 2bi #2
M9K2`Q /2 T H p` b2 /2MbB/ /2 H2tB+ HX S ` + / MQp2H- b½Q KC
/2 h #2H b b2`B / b MQ aSaaX S`BK2B`Q- Q 7Q`Q`2H ï½Q HBM2 M M2`b
Q +Q2}+B2Mi2 /2 +Q`2H ï½Q MQb b2Bb MQp2Bb /Q *16_ 2- 2K b2;
2tTHB+ ` Qb +Q2}+B2Mi2b i2tiQ`H2iS X p` b
P +Q2}+B2Mi2 /2 +Q`2H ï½Q /pûK /Q T`BK2B`Q T bbQ / M€HBb
/Q LQp2H R 2 /2i H? / b2;mB`X S`Q+2/BK2MiQ bBKBH `7QB THF
p2`B}+ ï½Q / 2tBbi M+B /2 mK +Q`2H ï½Q 2Mi`2 Q M9K2`Q iQi
2 b2mb 2H2K2MiQb Q72`2+2 /B72`2Mi2b BM7CSX `ïäQMi2b+Q`2H2H+2½
+Q`2H ï½Q 2Mi`2 b./2MbB/ /B€p2Bb H/2S H p`m H û /2 yX899 M2bb2
2 [m MiB}+ 7Q`ï 2 /B`2ï½Q HBM2 `2Mi`2 b /m b p `B€p2BbX 1b
K2/B/ [m2 Q M9K2`Q /2 T H p` b mK2Mi - /2MbB/ /2 H2tB+ H/BKB
Q LQp2H /2 aB; MBY+ Qp+ B QUT @p`Hm2V @ hQi H/2S H p`
+Q`2H ï½Q 2Mi`2 b /m b p `B€p2Bb i2` Q+Q`B/Q TQ` + bQ Qm M
bB/Q TQ` + bQ 2- TQ`i MiQ- û +QMbB/2` / bB;MB}+ iBp X SQ`9Hi
/ KQbi` U9N3 i2tiQbVX
LQ MQp2H R- Qb`2bmHi /Qb bm;2`2K mK +Q`2H ï½Q M2; iBp 7
2K mK i2tiQ 2 bm /2MbB/ /2 H2tB+ H- 2 2bb `2H ï½Q û 2bi iBbiB+
Qb i2tiQb b2 iQ`M K K Bb HQM;Qb U+QK K Bb T H p` bV- 2H2b i2M/2
2- Bmp2`b K2Mi2- i2tiQb K Bb +m`iQb i2M/2K i2` mK /2MbB/ /2 H2
[m2 i2tiQb K Bb HQM;Qb TQ/2K BM+HmB` T H p` b`2/mM/ Mi2b Qm
/2MbB/ /2 H2tB+ H K2MQ`X 1Mi`2i MiQ- BbbQ /2K M/ `B mK M€HB
/2bi2 2bim/QX
LQ MQp2H k- Qb`2bmHi R KQb+7X \$B2mQ +Q2}+B2Mi2 / +Q`2H
2Mi`2 b /m b p `B€p2Bb û T`QtBK / K2Mi2 yXR9k- Q [m2 bm;2`2 m
b /m b p `B€p2BbX *QKQ Q+Q`2m +QK Qb i2tiQb MQ MQp2H R- `H
i2tiQ mK2Mi - /2MbB/ /2 H2tB+ H i2M/2 /BKBMmB`- 2 pB+2 @p2`b
y-yR Uk 2ti`2KB/ /2bV 2 BM/B+ [m2 +Q`2H ï½Q û bB;MB}+ Mi2 2

6B;m`X*Q2}+B2Mi2b /2 *Q``2H Ĩ½Q 2 o HQ`2b /2 i Ui@p Hm2VX
6QMiP,b miQ`2bX

6B;m`XRQ``2H Ĩä2b LQp2H RX
6QMiP,b miQ`2bX

+QM} MĪ 2 M½Q Q+Q``2m TQ` + bQX LQ 2Mi MiQ- û BKTQ`i Mi2 7`B
bB;MB}+ iPp - 7Q`Ī / +Q``2H Ĩ½Q 2Mi`2 b /m b p `B€p2Bb û`2H
LQ MQp2H "R- 2pB/2M+BRkQb +Q2H)+6B;Mi2 /2 +Q``2H Ĩ½Q /2 S2`
/ K2Mi2 y-Rk9X *QKQ Q+Q``2m MQb MQp2Bb R 2 k- +Q``2H Ĩ½
bB;MB}+ iPp MQ MQp2H /2 bB;MB}+•M+B /2 y-yR U#BH i2` HV- Q
+ bQX P +Q2}+B2Mi2 /2 +Q``2H Ĩ½Q y-Rk9 bm;2`2 mK +Q`hQĪ½Q
i H/2S H2p2MbB/ /2G2BM/B+ [m2- +QM7Q`K2 Q M9K2`Q iQi H /2 T
mK2Mi - /2MbB/ /2 H2tB+ Hi2M/2 mK2Mi`HB;2B` K2Mi2- 2 pB
MQb MQp2Bb R 2 k- `2bT2+iBp K2Mi2X LQ 2Mi MiQ- û BKTQ`i Mi
K2Mi2 bB;MB}+ iPp - 7Q`Ī / +Q``2H Ĩ½Q û`2H iPp K2Mi2 7` + 2
TQ/2K BM~m2M+B ``2H Ĩ½Q 2Mi`2 2bb b p `B€p2Bb- +QKQ 2M7 iB
/2 T H p` b`2/mM/ Mi2b Qm K2MQb BM7Q`K iPp bX

6B;m`XRQ`2H İä2b LQp2H kX
6QMiP,b miQ`2bX

6B;m`XRQ`2H İä2b LQp2H "RX
6QMiP,b miQ`2bX

Pb`2bmHi /Qb 2pB/2M+P; //QbMQp2H; mk- BM/B+ K [m2 Q +Q2}+B2
2Mi`2 b /m b p `B€p2Bb û /2 T`QtBK / K2Mi2 y-yRR- Q [m2 bm;2`
7` + X AbbQ [m2` /Bx2` [m2 T` iB+ K2Mi2 M½Q ?€`2H İ½Q HBM2
p HQ` /2 bB;MB}+iBp /2 +Q`/Q +QK Qb MQp2Bb /2 bB;MB}+4M+yB+XMP2M
/B72`2Mi2 /Qb MQp2Bb Mi2`BQ`2b- +Q`2H İ½Q 2Mi`2 b /m b p `E
M½Q TQbbmB bB;MB}+ /Q T`€iB+Q Qm`2H2p Mi2 2bi iBbiB+ K2Mi2

6B;m`XRQ`2H İä2b LQp2H "kX
6QMiP,b miQ`2bX

LQ MQp2H *R- +Q`2H İ½Q 2Mi2 /2 Sb;P. P M 5 P 2 B 0 G 2 B + iB biB+ K2M
bB;MB}+ iBp MQ MQp2H /2 y-yR U/m b 2ti`2KB/ /2bV- bm;2`BM/Q
`2bmHi /Q B;M}+Q2}+B2Mi2 /2 +Q`2H İ½Q û /2 T`QtBK / K2Mi2
+Q`2H İ½Q M2; iBp KQ/2` / 2Mi`2 b /m b p `B€p2BbX AbbQ [m2`
T H p` b 2K mK i2tiQ mK2Mi - /2MbB/ /2 H2tB+ Hi2M/2 /BKBMmE
i` MbT`2+2 mK`2H İ½Q BMP2`b 2Mi`2 b p`aB;X 2B;KQP [# B ty y
T`2/Bx [m2 û # bi Mi2 BKT`Qp€p2H [m2 +Q`2H İ½Q Q#b2`p / i2M
`2H2p Mi2 T` 2bi2 2bim/QX

6B;m`XRQ`2H İä2b LQp2H *RX
6QMiP,b miQ`2bX

SQ`9HiBKQ- MQ MQP2HQk UöBn hi /Qb BM/B+ K [m2 Q +Q2}+B2Mi
p `B€pQBH/2S H. pMbb/ /2G@ByX yjN- bm;2`BM/Q ? p2`mK +Q`2H
7` + - Qm b2D - ?€TQm+ Qm M2M?mK `2H İ½Q HBM2 `2Mi`2 2bb
û +QMbB/2` /Q`2H iBp K2Mi2 HiQ- 2ti2`M M/Q [m2 +Q`2H İ½Q
T2HQ + bQ- K b [m2 K2bK M½Q û 2bi iBbiB+ K2Mi2 bB;MB}+ iBp
Q+Q`2m 2K "k- T `2+2 M½Q ? p2`mK +Q`2H İ½Q bB;MB}+ iBp Qr

6B;m`XRQ`2H İä2b LQp2H *kX
6QMiP,b miQ`2bX

S ` +QM}`K ` M€HBb2 BMB+B HK2Mi2 72Bi mb M/Q 7mMİ½Q -
7mMİ½Q `2;`2bb½Q HBM2 `X .2Mi`2 b bm#/BpBbä2b /2bi 7mMİ½Q-
*Q2}+B2Mi2b- [m H b2 bm#/BpB/2 2K /QBb +Q2@+B2MmQ2M b/iB MiB M2i
+Q2}+B2Mi2 pi @Q VhQ2 UH/2S X pK2bK M€HBb2 7QB +QM/mxB/ 2K
û BHmbi` / MR 6B;B HBx M/Q Q`2bmHi /Q /Q MQp2H RX

6B;m`XRQ2}+B2Mi2b LQp2H RX
6QMiP,b miQ`2bX

h #2HQ2}+B2MmQ2M bûK BM7Q`K İä2b bQ#`2 Qb +Q2}+B2Mi2b /Q KQ
Dm/ K- M2bi2 2bim/Q- +QKT`22M/2` b`2H `B€p2HMTUQ BiQ`2 SK @ M
H pV Q p `B€p2H /2T2M2M B/2/2G/2tBR +HQ2}+B2Mi2 T /`QMBx /Q U`2
BKTQ`i•M+B `2H iBp /2 + / p `B€p2HT`2/BiQ` M 2tTHB+ İ½Q / p
P p HQ`/2 iBM/B+ [m MiQb 2``Qb T /`½Q Q +Q2}+B2Mi2 2bi€ 7 bi
x /Q Q72`2+2 mK B/2B /Q i K M?Q /Q 272BiQ 2K i2`k QH Q`222Q pBQ

p HQ` /2 bB;MB;X M b BM H K bB;MB}+•M+B 2bi iQbiB+ /2 + / +Q
LQ [m2 /Bx`2bT2BiQ`2;`2bb½Q MQ LQp2H R- TQ`i MiQ- Q +Q2}
/BiQi H/2S Hmp;2b2 [m2- " K2/B/ [m2 Q M9K2`Q iQi H /2 T H p` b 2
/2MbB/ /2 H2tB+ Hi2M/2 /BKBMmB`X K#Qb Qb +Q2}+B2Mi2b b½Q
KQbi` M/Q [m2 b`2H İä2b/B}+BHK2Mi2 Q+Q`2` K TQ` + bQX bbB
H2b Q#iB/Qb M M€HBb2 /Q +Q2}+B2Mi2 /2 +Q`2H İ½Q M T`BK2B
LQp2H k UF6; K [m2 Q +Q2}+B2Mi2 M2; iBpQ ThQi Hp/2S €p#HÜK 2/Bi
+QM}`K [m2- " K2/B/ [m2 Q M9K2`Q iQi H /2 T H p` b /2 mK i2tiQ
i2M/2 /BKBMmB` HB;2B` K2Mi2X K#Qb Qb +Q2}+B2Mi2b b½Q 2bi
T`*QMbi MT24 y-yyRhtQi H/2S M p b BM HBx K [m2 b`2H İä2b/B}+B
TQ` + bQX

6B;m`XRQ2}+B2Mi2b LQp2H kX
6QMiP,b miQ`2bX

Pb`2bmHi /Qb Q#iB/Qb MQRVQip#HÜ"R+U6`BQ#`Q` K Qb Q#iB/Qb T2
+Q2}+B2Mi2 /2 +Q`2H İ½Q M T`BK2B` T`i2/ M€HBb2X P +Q2}
iQ`hQi H/2S H M/Bb+ [m2- " K2/B/ [m2 Q M9K2`Q iQi H /2 T H p` b 2
/2MbB/ /2 H2tB+ Hi2M/2 mK2Mi`HB;2B` K2Mi2X K#Qb Qb +Q2}
+ iBpQb UT l y-yyRhtQi MT24 y-yye HQi H/2S M-p`2+QMBx M/Q [m2 b
/B}+BHK2Mi2 Q+Q`2` K TQ` + bQX

6B;m`XRQ2}+B2Mi2b LQp2H "RX
6QMiP,b miQ`2bX

C€ MQ LQp2H "RMU6B+Q2}+B2Mi2 TQbBiBpQ ThQi p/2S€H2MÜb 2/Bi
? p2`mK bbQ+B İ½Q TQbBiBp 2Mi`2 Q M9K2`Q iQi H /2 T H p` b
û 2ti`2K K2Mi2 T2[m2MQX C€ Q p HQ` /2 T M½Q bB;MB}+hQp@@y-
/2S H p`2p2H [m2`2H İ½Q 2Mi`2 2bb2 T`2/BiQ`2 p`B€p2H /2T
bB;MB}+ iBp - +QM}`K M/Q Q [m2 7QB bm;2`B/Q T2H M€HBb2 /Q +C
/ M€HBb2X

LQ MQp2H *Rk W6 B; mQ2}+B2Mi2 M2; iBpQ T`hQp HB2S 2H-BM 1/BxQ
? p2`mK bbQ+B İ½Q M2; iBp 2Mi`2 Q M9K2`Q iQi H /2 T H p` b
" K2/B/ [m2 Q M9K2`Q /2 T H p` b /2 mK i2tiQ mK2Mi - /2MbB/ /
+Q`Q#Q` M/Q Q [m2 7QB p2`B}+ /Q M M€HBb2 /Q +Q2}+B2Mi2 /2 +
P HiQ p HQ` #bQ@p iQm2 9Uy98V 2 Q p HQ` /2 T KmBiQ # BtQ UK2
p`B€p2H ThQ/BHQ2S H M/Bb+ K [m2`2H İ½Q 2Mi`2 2bi 2 p`B€
2bi iBbiB+ K2Mi2 bB;MB}+ iBp X

SQ` }K- MQ MQp2H Rk QpBHQ` /2 iUi@p Hm2V 2 Q p HQ` bbQ+B /Q
bQ#`2 bB;MB}+•M+B 2bi iQbiBHQV Hp/2S €p p2b2`2#BbQ- Q p HQ` /2

6B;m`XRQ2}+B2Mi2b LQp2H "kX
6QMiP,b miQ`2bX

6B;m`XKQ2}+B2Mi2b LQp2H *RX
6QMiP,b miQ`2bX

hQi H/2S Hypj`3N- û +QMbB/2` /Q`2H iBp K2Mi2 HiQ 2 bm;2`2 [m2`
TQ/2 M½Q b2` 2bi iBbiB+ K2Mi2 bB;MB}+ iBp 2- TQ`i MiQ- +QM}`K
/2 +Q`2H Ĩ½QX /2K Bb- Q # BtQ +Q2}+B2Mi2 T /`QMBx /Q U"2i V U
[m2` p`B€p2H T`2/BiQ` M½Q T`2+2 i2` mK BKT +iQ bm#bi M+B H

6B;m`XKQ2}+B2Mi2b LQp2H *kX
6QMiP,b miQ`2bX

T`2b2Mi /Qb Qb / /Qb 2 BM/B+ /Qb Qb`2bmHi /Qb- Q`B2Mi /Qb
T`!tBK b2Ĩ½Q b½Q /Bb+miB/Qb 2bb2b`2bmHi /Qb 2 BM/B+ / b b +C

8 .Bb+mbb½Q 2 +QMbB/2` Ĩä2b }M Bb

1bi2 2bim/Q /Bb+miBm 2b+`Bi 2K HQM;m b /B+BQM Bb T` +QKT
/B;Bi Bb 2t2`+2K M T`Q/mĨ½Q i2tim HX S` i MiQ- M HBbQm /2
Ga6>UHHRN3BNMj2K m+Q`T`2b mHi Mi2 /2 b2Bb i`27 b T`Q/mxB/ b`
+BM+Q B/BQK b U H2K½Q- 2bT M?QH- 7` M+ b- Bi HB MQ 2 TQ`im;
2bb b HQM;m b 2 MQp2Bb /2 T`Q}+B M+B T` B/2MiB}+ `b2 ? p2`B
i2tim HX

M€HBb2 7QB bBbi2K iBx / 2K i #2H b 2 };m` b T` pBbm HBx`
HQM;m b /B+BQM Bb 2`2bT2+iBpQb MQp2Bb /2 T`Q}+B M+B X 1pB
2K + / HQM;m U+7Xe 2B;#2Hb2j V- T` p2`B}+ `Q [m½Q +QMbBbi2M
p HQ`2bX

*QK`2H Ĩ½Q` T`BK2B` T2`;mMi /2 R2b€mB#2HU2j7 X 66B,mV`- b
Qb`2bmHi /Qb KQbi` `K [m2` 72` K2Mi /2 A M½Q û b2MbQp2H
BM/B+ / b T` `2 HBx Ĩ½Q / i`27 M2K` p`B€p2H T`Q}+B M+B X
2ti2Mb½Q /Bp2`b Q bQHB+Bi /Q- M½Q +QMbB/2` M/Q Qb MQp2Bb

$\backslash 2bmHi / Q BM+QM; \backslash m2Mi2 Q 2bT2 \backslash / Q M T \backslash Q / m \dot{I} \frac{1}{2} Q / 2 i2tiQb 2K mK$
 $Pb \backslash 2bmHi / Qb \backslash 2H iBpQb \text{ " } b b2; mM / \backslash 2 i2 \backslash +2B \backslash T2 \backslash ; mMi b / 2bi2 2$
 $T \backslash Q / mx Bm / / Qb [m2 b2; m2K mK K2bKQ T / \backslash \frac{1}{2} Q - BM / 2T2M / 2Mi2 / H$
 $p2 \backslash B \} + / Q M 2ti2Mb \frac{1}{2} Q / Qbi2tiQbc MQ 2Mi MiQ - 2Mi \backslash 2 Qb MQp2Bb / 2$
 $T \backslash Qb i2tiQb / Q MQp2H \text{ " } RX 1bb2 T / \backslash \frac{1}{2} Q \dot{u} \backslash 2Bi2 \backslash / Q [m M / Q b2 p2 \backslash B$
 $HQM; m \backslash 2 MQp2Bb / 2 T \backslash Q \} + B M + B X 1K Qmi \backslash b T H p \backslash b - BM / 2T2M / 2$
 $T \backslash Q / mx i2tiQb [m2 \backslash 2p2H K / B72 \backslash 2M \dot{I} b K \backslash + Mi2b 2Mi \backslash 2 Qb MQp2Bb$
 $S \backslash \backslash 27Q \dot{I} \backslash Qb \backslash 2bmHi / Qb \backslash 2p2H / Qb T2HQb / / Qb 2bi iQbiB + Qb$
 $7Q \backslash K \backslash 2 HBx / b + QK Q T \backslash QTib \text{ " } Q / Shp2 \backslash B \} mx \backslash b 2Qb \dot{q} m2 / 2KQMbi \backslash K$
 $2Mi \backslash 2 / 2MbB / / 2 H2tB + H 2 2ti2Mb \frac{1}{2} Q i2tim H 6 2K + X / T \backslash Q p2Mi / 2$
 $T2b [mBb VX Pb \backslash 2bmHi / Qb / Qb + Q2 \} + B2Mi2b \backslash 2p2H \backslash K b2; mBMi2$
 $/ 2MbB / / 2 H2tB + H, T \backslash Q MQp2H R - mK M \frac{1}{2} Q + Q \backslash \backslash 2H \dot{I} \frac{1}{2} Q M2; iBp$
 $T \backslash Q MQp2H \text{ " } R - + Q \backslash \backslash 2H \dot{I} \frac{1}{2} Q TQbBiBp 7 \backslash + - / B72 \backslash 2M + B M / Q @ b2$
 $/ B72 \backslash 2M \dot{I} Q \# b2 \backslash p / 2K i2 \backslash KQb / 2 T2 \backslash + 2Mim Bb / 2 / 2MbB / / 2 H2t$
 $p2 \backslash B \} + Qm @ b2 mK + Q \backslash \backslash 2H \dot{I} \frac{1}{2} Q TQbBiBp KmBiQ 7 \backslash + c MQ MQp2H *$
 $*k - + Q \backslash \backslash 2H \dot{I} \frac{1}{2} Q M2; iBp KmBiQ 7Q \backslash i2X$
 $S \backslash \backslash +QM \} \backslash K \dot{I} \frac{1}{2} Q / 2bb2b \backslash 2bmHi / Qb - 2KT \backslash 22M / 2m @ b2 mK M \in$
 $HBM2 \backslash X Pb \backslash 2bmHi / Qb KQbi \backslash \backslash K + Q2 \} + B2Mi2 M2; i @ Bp \text{ " } H2 + Q 2$
 $S H pMQ MQp2H R - \backslash 2Bi2 \backslash M / Q M \in HBb2 Mi2 \backslash BQ \text{ " } c Q MQp2H k \backslash 2$
 $U @ p \text{ " } H / 2S H pMQ p2H \text{ " } R + QM \} \backslash KQm Q \backslash 2bmHi k / Qm \text{ " } B + Q2 \} MB 2$
 $b \frac{1}{2} Q 2bi iBbiB + K2Mi2 TQbBiBp \text{ " } Q / 2S H pMQ p2H \text{ " } k \backslash 2p2HQ$
 $+ B2Mi2 TQbBiBp Q - bbQ + B \dot{I} \frac{1}{2} Q TQbBiBp 2Mi \backslash 2 b p \backslash B \in p2Bbc Q M$
 $p \backslash B \in p2H \text{ " } H / 2S H pMQ p2H \text{ " } K bbbQ + B \dot{I} \frac{1}{2} Q M2; iBp 2Mi \backslash 2 Q M9K2 \backslash Q i$
 $/ 2MbB / / 2 H2tB + HX 6BM HK2Mi2 - Q MQp2H *k 2tB \# Bm bB; MB \} + \bullet M -$
 $7QB bm; 2 \backslash B / Q M M \in HBb2 / Q + Q2 \} + B2Mi2 / 2 + Q \backslash \backslash 2H \dot{I} \frac{1}{2} Q X$
 $SQ \backslash i MiQ - Qb \backslash 2bmHi / Qb T2 \backslash KBi2K [m2 b2 + QM + Hm [m2 - T \backslash iB \backslash$
 $HQM; m b / B + BQM Bb - 72 \backslash \backslash K2Mi / 2 A M \frac{1}{2} Q \dot{u} b2MbQp2H \text{ " } b + \backslash +$
 $TQ \backslash 2t2KTHQ - HQM; m b / B + BQM Bb K Bb / 2bBM2M + B Bb 2K \backslash 2H \dot{I} \frac{1}{2}$
 $i2 \backslash KQb T2 \backslash + 2Mim Bb b \frac{1}{2} Q KQ / 2 \backslash / bX H \dot{u} K / BbbQ - M \frac{1}{2} Q b2 Q \# b2 \backslash pQ$
 $? p2 \backslash H; mK HQM; m - / 2Mi \backslash 2 b + BM + Q - [m2 \backslash 2p2H bb2 mK T / \backslash \frac{1}{2} Q K$
 $H / Q - H2p M / Q @ b2 2K + QMi p \backslash B \in p2H MQp2H / 2 T \backslash Q \} + B M + B - Q \#$
 $MQp2H k - [m2 b2 / B72 \backslash 2M + B / Qb / 2K Bb - 2 Q MQp2H *R - [m2 T \backslash 2b2$
 $H2tB + H 2K iQ / b b HQM; m b - \backslash 2bmHi / Q [m2 / B72 \backslash 2 / [m2H2b [m2$
 $+ QMi2tiQ / 2 HQM; m QM Bk + BQM \text{ " } Hm b \backslash c - k m \text{ " } B X Q$
 $1bb2b \backslash 2bmHi / Qb / Bp2 \backslash ; 2K / b Q \# b2 \backslash p \dot{G} \dot{I} \frac{1}{2} b \text{ " } Qb \text{ " } b [MQ 2bH 2Q / 2 [$
 $Q *? i: Sh \backslash 2bTQM / 2 / 2 K M2B \backslash T \dot{u} @ / 2i2 \backslash KBM / + QK \# b2 2K bm T \backslash C$
 $pBbiQ [m2 - b2 K2bK 2Mi \backslash / 7Q \backslash BMb2 \backslash B / - i2M / M + B / 72 \backslash \backslash K2M$
 $/ Bp2 \backslash ; M + B / Bx \backslash 2bT2BiQ Q 7 iQ / 2 72 \backslash \backslash K2Mi T \backslash Q / mx B \backslash i2tiQb + C$
 $/ B + BQM Bb - MQp2Bb / 2 T \backslash Q \} + B M + B 2 / 2MbB / / 2 H2tB + H - 2K \# Q \backslash$
 $/ 2 + / HQM; m TQ / 2 \backslash B K b2 \backslash / 2i2 \backslash KBM Mi2bX 2bb2 \backslash 2bT2BiQ - Qb$
 $[m HBi iBpQ T \backslash + / mK + Qb \text{ " } i2biQb / Q$
 $Pb \backslash 2bmHi / Qb i K \# \dot{u} K / \frac{1}{2} Q BM / B + \dot{I} \dot{a} 2b / 2 [m2 72 \backslash \backslash K2Mi T \backslash 2 + B$
 $H2p \backslash 2K + QMi b + \backslash + i2 \backslash QbiB + b HBM; mQbiB + b / 2 + / HQM; m /$
 $i2M? K / / Qb + QM \} \in p2Bb [m2 TQbb K \backslash 2p2H \backslash T \backslash Q \} + B M + B HBM; m$
 $T \backslash Q / m \dot{I} \frac{1}{2} Q 2b + \backslash Bi b2K mtQHbQ / A X L2bb2 b2MiB / Q - Q mbQ / 72 \backslash \backslash$
 $+ QMi2 + 2 \backslash + QK T \backslash + BK - MB X$
 $+ QMi \backslash B \# mB \dot{I} \frac{1}{2} Q / 2bi2 2bim / Q - 2t2K TH + QK Q \text{ " } B M \text{ " } B M \text{ " } H2BQ Q \text{ " } mi:$
 $\dot{u} T \backslash i2 / Q / 2b2MpQH pBK2MiQ i2 + MQH \dot{I}; B + Q [m2 T \backslash 2 + Bb b2 + Q / mM$
 $T \backslash [m2 2bim / Mi2b Qm mbm \in \text{ " } BQb / 72 \backslash \backslash K2Mi + QKT \backslash 22M / K, Q m \text{ "}$
 $\dot{I} \dot{a} 2b - M \frac{1}{2} Q b2M / Q mK bQHm \dot{I} \frac{1}{2} Q K \in; B + T \backslash T \backslash Q / mx B \backslash i2tiQb 2b + \backslash Bi$
 $TQbbm2K 2tB; M + B b / B72 \backslash 2Mi2b - + QKQ \dot{u} Q + bQ / Q 2MbBMQ / 2 HQ$
 $M2bb b HQM; m b T \backslash M \frac{1}{2} Q ; 2 \backslash \backslash / Qb BKT \backslash 2 + BbQbc TQbbB \# BHB /$

[m MiQ " /2MbB/ /2 H2tB+ H- 2bi2 `iB;Q û TBQM2B`Q 2K #Q`/ ` Q
+QMì`B#mBİ½Q û +QKT`22M/2` +QKTH2tB/ /2 /Qb i2tiQb [m2 b½Q
6mim` b T2b[mBb b b½Q M2+2bb€`B b +QK i2tiQb T`Q/mxB/Qb T2
[m HB/ /2 2 +QKTH2tB/ /2 / 2b+`Bi 2K i2`KQb / Q`; MBx İ½Q
+QKTH2tB/ /2 bBMi€iB+ 2 KQ/ HB/ /2 2 p HB iBpB/ /2 bQ# T2`bT
[m2 M HBb2K Qb i2tiQb [m HBi iBp K2Mi2 2 `2H +BQM2K [m HB/
/2 T`Q}+B M+B /2 +Q`/Q +QK Q *16_ b2`½Q #2K@pBM/ bX SQ` }K-
7Q`K Qb i2tiQb T`Q/mxB/Qb T2HQ *? i:Sh TQ/2K H2p Mi ` [m2biä
+QMì`B#mBİä2b T ` Q /2b2MpQHpBK2MiQ /Q +m`Q+mHQ MQ 2MbB

e 6BM M+B K2MiQ

+QH2i /2 / /Qb T ` Q T`2b2Mi2 2bim/Q 7QB }M M+B / TQ` K2BQ /Q
Q7 1bb2t- _2BMQ IMB/Q- 27 x T `i2 /Q T`QD2iQ ôh?2 1z2+i Q7 *? i:S
G M;m ;2b, avbi2KB+ 6mM+iBQM H GBM;mBbiB+b M HvbBbôX

_272` M+B b

L.1_aPL- L b?c "1G ou- . MB2H GXc S1_G1- ai2T?2M JXc >1L._A*Ea- a? `L
o1_> :1L- 1p2`ic J1JPL- KB`_X A /B/ MQi r`Bi2 i?Bb K Mmb+`BTi- Q` /B/
/2i2+iQ` BMiQ ;2M2` i2/ i2tib\ h?2 TQi2MiB H 7mim`2 Q7 *? i:Sh M/ A BM
K Mmb+`BTi ;2M2C P B Q M X T Q `i 1t2`+Bb2X 2/-BM B NR 2yyR8e3- 72pX kykX A
ky88@de9dRy XPRRjef#KDb2K @Xy Bjb@ QNRQ p 2H 2K,
?iiTb,ff#KDQT2Mb2KX#KDX+QKf XQ M2 B M Qf Q KR f2Ry MRQ p X kykX

*G o1G@ __PAhA - "2;-MB c S1LLP*E@aS1*E- " `vX M HvbBM; H2tB+ H /
bQT?BbiB+ iBQM BM r`Bii2M M/ bTQF2M*Q K I 2 m Q2H Hb#G biiB/pQ 2/t;mf ;M;Q 2X
1H2+i`QMB+ CQm`MpX Wk-GK@-1CX kJy k8y- kykRX .BbTQM Qp2H 2K,
?iiT,ff+ HH2DXQ`;fDQm`M Hfkk @Xjf +2 b2Q 2Ka Tkj +Fhk MxRkyTk/jX

*PGPJ"A- J `B *2+BHB X + /2KB+ H M;m ;2 /2p2HQTK2MM BM G iBMQ bim
a*>G1SS1:_1GG- J `v CXc *PGPJ"A- J `Bp2 2 Q B T B M ;U2p XW+2/ HBi2` +v BM }
b2+QM/ H M;Jn ?;2B, G r`2M+2 1`H# mK bbQ+B i2b- kyyyX TX ed 3eX

. G1- _Q#2`iX :Sh@j, q? iöbLBiimQ G/G 7 M ;m ;2 1Mp X M 2 2 N B M R- TX RRj RR3-
kykRX AaaL Rj8R @jk9N- R R y X F O 3 R R R y k j 8 R A k 9 N . B b T Q M Q p 2 H 2 K ,
?iiTb,ffrrrX+ K#`B/;2XQ`;f+Q`2fT`Q/m+ifB/2MiB7B2`faRj8 R k 9 2 b b Q y 2 k y R
kR MQpX kykX

.1>Pl*>1- LX SH ;B `BbK BM i?2 ;2 Q7 K bbBp2 :2M2` iBp2 S 12 @B + B B M / h`
a+B2M+2 M/ 1MpB`QM p 2 M i R H S X R B i B j + b K `X kykRX AaaL R3ej @89R8- ReR
RyXjj89f2b2Xy B B N Q M Q p 2 H b 2 K r r r X B M i @ ` 2 b X + Q K f # b i ` + i X f 2 2 B 5 Q 2 K f T k R d @
MQpX kykX

.1_Lu1A- wQH26M X+? K2i?Q/b BM T T X B L 2 / r G B M F, m B t 7 i G ` / b l M B p 2 ` b B i v S ` 2 b b

6_1>GAL:- G2QM c w l " A : - `F B i x X 6 2 i m ` 2 @ # b 2 / / 2 i 2 + i B Q M Q 7 m i Q K i 2 /
:Sh@k- :Sh@j M / S 2 Q p Q ` X Q K T m i 2 ` p X B i 2 M 9 9 j - # ` X kykRX AaaL k j d e @ 8 N N k
R y X d d R d f T 2 2 X D @ b + T b Q M Q p 2 H b 2 K T 2 2 ` D X + Q K f ` X B + 2 H b Q + 2 K @ 9 R j M Q p X kykX

:1>_J LL- a2# biB M c a h _ P " 1Gh- >2M/`BFc _la>- H2t M/2` JX :Gh_, ai iBb
oBbm HBx iBQM Q7 :2M2` i2R h 2 9 i 3 k 8 y R N X A R A , R N . B b T Q M Q p 2 H 2 K ,
?iiTb,ff`tBpXQ`;f #bXR N 2 b B Q 9 2 K j k R M Q p X kykX

:AG- Mi-MBQ`QK B Q B X #Q` ` T`QD2iQ B X 2 2 T X b a [m B S m H Q , i H b - k y y k X

:PLw•G1w 61_L•L.1w- /2H X "B; / i v +Q`Tmb HBM;CQbiB+Qb T ` 2H 2bim
aFQTQb N- Ryd @ R k y R B X y A 3 a L k k 8 8 @ j d y j X . B b T Q M Q p 2 H 2 K ,
?iiT,ff?2HpB X m + Q X 2 b f t K H m B X ? + 2 b b Q 2 K j , N k e R R M Q p X 8 kykX

:_1:P_A@aA:L1a- * `K2Mc *G o1G@ __PAhA - "2;Qç X M HvbBM; G2tB+ H
BM IMBp2`bBiv aim/2Mibö c`EQi2MBB@+@Qn+ B 2H M/ "2? ppXBQN 3H ā XB22M+28e
DmHX kyR8X AaaL R RdyRyRk3xfDPAb,#bT`X XBkyRQ MyQp29H d K,
?iiTb,ffHBMFBM;?m#X2Hb2pB2`X+QKf`2X B+22b2f Q2Bk a RB dMq p K3kykyX 9d3s

> GGA. u- JB+? 2H H2t M/2T@B2MrCQ/Q`X Bii2M :H22M;Q M;2 .2 FBM IMBp2`bBi
RN38X UG M;m ;2 2/m+ iBQMvX

> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/X aTQF2M M/ArMBii2M KQ/2b Q7 K2
>P_PqAhw- _Qb HBM/c a JI1Ga*CaKTC2Q 2M2/BMXQ` H M/ rXBPr2MMH/Q; m ;2
+ /2KB+ S`2bb- RN3dX TX 88 3kX

> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/X.Su`JB+? 2H H2t M/2`EB`FrQQ/c
> a L- _m[Bv G2MK;vX;2- +QM2iX KM/22XiPt7Q`/, Pt7Q`/ IMBp2`bBiv S`2bb-

> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/X aQK2:`KK iB+ H S`M,#H2Kb BM a
> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/c J _hc`B-i B K b +B#2M + 2,2GvVX` +v I
/Bb+m`bBp2GfQM2QM- L2r uQ`F, _QmiH2;/2- RNNjX TX de N9X

> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/X h?2 bTQF2M H M;m ;2 +Q`Tmb, 7
i?2QK`AM,"ah1_- CQM i? M CQKUT2r/X MBQM H M/ [m MXBG QM/p Q MimL B2 bQ`F,
*QM iBMMmK- kyy8X TX R8d RnyX

> GGA. u- JB+? 2H H2t M/2`EB`FrQQ/c J hh>A1aa1L- *?`BbMB M J i?B b A
AMi`Q/m+iBQM iQ 6mMxiBXQ M/ XiG`MKQM, 1/r `/ `MQH/- kyR9X

CP> LaaPL- oB+iQ`B X G2tB+ H /Bp2`bBiv M/ H2tB+ H /2MbBiv BM bT22+?
T2`bT2+q Q p2BX M; S T2`b BM p2B Mj;mTBb eBR+ dN- kyy3X

E aL1*A- 1MF2H2D/ c a1aaG1_- E i?`BMc EB*>1J LL- ai27 Mc " LL1_h- J `
.1J1LhA1o - .`vM c 6Aa*>1_- 6` MFC : aa1_- l`bc :_P>- :2Q`;c :BLL1J LL-
>BGG1_J1A1_- 1vF2c E_la*>1- ai2T? Mc ElhuLAPE- :Bii c JA*> 1GA- hBHK
S61661_- CC`;2Mc SPZ11h- PH2Fb M/`c a AG1_- JB+? 2Hc a*>JA.h- H#`2
ah .G1_- J ii?B bc q1GG1_- CQ+?2Mc El>L- CQ+?2Mc E aL1*A- :D2`;DBX *
QTTQ`imMBiB2b M/ +? HH2M;2b Q7 H `;2 HGM ;m B2MK QM2 HBM7 Bp B#m +Hi.BQ B
pX Ryj- TX Rykkd9- #`X kykjX AaaL R RdyRyRk3xfDPAb,#bT`X XBkyRQ MyQp29H d K,
?iiTb,ffHBMFBM;?m#X2Hb2pB2`X+QKf`2X B+22b2f Q2Bk a RB dMq p K3kykyXy RN8

E1J" _1L- 6 `B/ _2T2HBi c aq LA- /2 LQpB` X 1tTHQ`BM; G2tB+ H .2MbB
1GGAh1, CQM`M H Q7 1M;HBb? G M;m ;2p X B i 2M X r k - 2T-X R R y N2 R+R2B-MM QpX ky
k8k3yyee- k8kd9 RkyXj k B A3f2HHB X2 XBpT B Q M Q p 2 H 2 K,
?iiT,ffDm`M HXmMKm?D2K#2`X +XB/fBM/2t XT +2f b1CG2K,1k R iB Q p X f p B k X f 3

EAL:- JB+? 2H _Xc *> h:ShX *QMp2`b iBQM QM `iB}+B H AMi2HHB;2M+2
1/m+ iB`QMMH M` M/ JQH2+mH-`p"XB B e-MMBKMR2-2T B MR; k- 72pX kykjX AaaL R3e
R3e8@8yjj R y R R ydfbRkRN8 @Xy.BkT Q M i Q p 2 H 2 K,
?iiTb,ffHBMFXbT`BM;2`X+QKfRyX Rky yd2 b R Q 2 K 8 @Ry iMk@pXy k 9 j Q 3

EPL. G- "QM H X 1z2+ib Q7 H2tB+ H /2MbBiv M/ H2tB+ H p `B2iv BM H M;R
AMi2`M iBQM H CQM`M H Q7 Ah- 1M;BM22`BM; M/ -TpXHB-2M X +Ry2-M+2b8_ B
kyR8X

EIJ _- `mMX M HvbBb Q7 *? i:Sh hQQH iQ bb2bb i?2 SQi2MiB H Q7 Bib li
"BQK2/B+ H .BQ B Q X- 1M;BM22`BM;- J2/B+B BM2X M/ aH+ B B M F X k 9 TjQ: iD MX
AaaL k989e3NB X X P 8 j,yf#2K X B N X T Q M Q p 2 H 2 K,
?iiTb,ffrrrX#2Kb`2TQ`ibXQ`;fBM/2tXT? TX # 2 B b Qi B K H2R p B Q p f R kly kjX

G L* ah1_- h?QK bX `iB}+B H B Mi2HHB;2M+2- i2ti;2M2` iBQM iQQHb M/
r i2`K `FBM; Qz2` A M H2m MB C B Q M H CQM`M H 7Q` p X n R+N i B Q M R H T X M R y;- B i m M
AaaL R3jj @k8 N B X X P 8 j,ydfb9yNdN @Xy.kB @TyQ M i Q p 2 H 2 K,
?iiTb,ff2/BMi2;`BivX#BQK2/+2Mi`HX+QKf`iB+HX2bf2Ry b Q R 2 K d f k R y M Q p X @kykj

J_hALa- J€`BQX .2MbB/ /2 H2tB+ H M 2baBBMmKj2itbQnb/2ib+/Q-9pB2lyk ;2K
MX R- TX kR3- K BQ kyRdX AaaLykKj@i98jdc@9P Ae XkyR. BdkTyQ/MRQp 2H 2K,
?iiT,ffrrrXm2HX#`f`2pBbi bfm2HfBM/2tXT? Tfb B2lbnQ 2Ki,Ek+RiM QpB2 kfykKk 8

JAh_PoAË- a M/`c L._1PG1hhA- . pB/2c uPI"- PK`MX *? i:Sh Q`>mK M
1tTH BMBM; .2+BbBQMb Q7 J +?BM2 G2 `MBM; JQ/2H 7Q`.2i2+iBM; a?Q`i
`sBp,kjyR XRj38kpRyKj+X XR9388yf _sAoXkXy. BkRQM Qp2H 2K,
?iiTb,ff`tBpXQ`;f #bXkky 2XkRQ 2K, kR MQpX kykX

JPP>1" h- JQ? KK /`2x c_ C- _ K:QT Hc E _11J- a K22K "BMiB #/mHc
h>P_G1l*>h1_- .B`FX A/2MiB7vBM; AaA@AM/2t2/ `iB+H2b #v i?2B` H2tB+
CQm`M H Q7 i?2 bbQ+B iBQM 7Q` AM7Q`KpiB QM- aM+B 2-MT+2 8 YR f2R-R MIQ HXk
kjyy@Rej8- kjyy@RR9XRyRaf bX XB pFTQM Qp2H 2K,
?iiTb,ff bBbi/HXQMHBm2HB#` `vXrBHxvX+2QkQ/QBfR RXNRQpKf klyB XkjRN9

L G1aaP- :BmHB X 1H /2b ``QHHQ /2 H +QKT2i2M+B HùtB+ /2 2bim/B Mi
P`BHH b, `BpBbi- M3bdf TMKj3iB +jN9- kyr3X AaaL kk3y @9jNyX .BbTQM Qp2H
?iiTb,ff/B HM2iXmMB`BQD X2bfb2`pHX2i+2bB Qm2HKk+RQMBQ,DX4 49 RjXRk3

L aa1_A- J `v Kc h>PJSaPL- S mHX G2tB+ H /2MbBiv M/ /Bp2`bBiv BM /Bb
1M;HBb? GR pbX Gk i2tib/Bz2B2Mm +2BkX M; TX Ryy8RR- D MX kykRX AaaL Ryc
RyXRyRefDX brXKy. ByXTQM Qp2H 2K,
?iiTb,ffHBMFBM;?m#X2Hb2pB2`X+QKf`2X` B+2p2f Q 2Bk, aRRy MBQpX8kykXy dke

L hAPL- AXaX S `mHBM; pQ+ #mH `v BMX MX27X)Hk M#nB /;22 IMBp2`bBiv S`2bb

S1_EALa- JBF2X + /2KB+ BMi2;`Biv +QMbB/2` iBQMb Q7 A G `;2 G M;m ;
*? i:Sh M/ #2vQOMXM H Q7 IMBp2`bBiv h2 +?BM-; pMkG-2M X MB M7, 2pX+ki BkX A
R99NNd3N- R99NNd3NjXeRAR Xky BlyTQM Qp2H 2K,
?iiTb,ff`QXmQrX2/mX mfdmXHf2pQG Kyf BbB MM QpX kykX

_ JPa- M i€HB a `BpAMi2iBMB; bM+B `iB}+B H :2M2` iBp # b2 / 2K;` M/
HBM;m ;2K @ 72`` K2Mi b /2 mbQ M aT2H XmbQ kykXK B A,
RyXR8Nyfa+B1GPSX2.TB bTQM Qp2H 2K,
?iiTb,ffT`2T`BMibXb+B2HQQXQ`;fBM/2tXT? Tfb+B2XHGf2b2Q`2BM,ikRBM QpX kykX

_1 .- CQ? Mx2bbBM; pQ+* #m#HB/v2, * K#`B/;2 IMBp2`bBiv S`2bb- kyRyX

_A66P- E `BM 6m2Mi2bc PaL - a2`;BQ >2`M€M/2xc G :Pa- S2/`Q a H+2/Q
/2MbB/ / HùtB+ b 2M MQiB+B b 2b+`Bi b TQ2 pBbm/B MB2b2/B`T22 BQB/MS brkQbX
pX RN- MX j- TX 9NN 8k3- b2iX kyRN R yAaB & RYNB 9i @e @Ne3X 3B AR Q M Qp2H 2K,
?iiT,ffrrrXb+B2HQQX#`fb+B2HQQXT? T`b+`BTi4b+Bn `ii2ti TBX4 a+2bB Q Q2k,N3
kR MQpX kykX

_PaSA:GAPaA- S2`B+H2b ò b?2`òX `iB}+B H BMi2HHB;2M+2 BM i2 +?BM;
Q7 *? i:SA Mi2` +iBp2 G2 `MBM; p1XmjR- Q M R2 M X R j- D MX kykX AaaL Ry9N
.PARyXRy3yfRy9N93kyXky. BjbTKQM Qp2H 2K,
?iiTb,ffrrrXi M/7QMHBm2X+QKf/QBf7mHHfRyX R+2bbyB Qy2K, 9kR yMQpXjkykXy

a*>LI_- 1`BMc _l"AP- 62`M M/QX G2tB+ H +QKTH2tBiv- r`BiBM; T`Q}+B2M+
G M;m ;2 AKK0` MB Q M X G2 `MBM; -h2X 7MB Q M Q;R- TX 8j dk- 72pX kykRX Aaa
.BbTQM Qp2H 2K?/HX? M/H2XM2Xf R+2bkbQ 2Kk & R MQpX kykX

I_1- C2 MX G2tB+ H /2MbBiv M/ `X; BSM12`_1Bz2`2QM iB 1BQ 2bic
h_AJ- CQ?M G2bHB2 J2THB H HB QM bXQ/X GBM; mBbiB+b, b2H2+i2/ TT2`b Q7
*QM;`2bb Q7 TTHB X/*GBM Bm B2biB K#`B/;2 IMBp2`bBiv S`2bb- RNdRX TX 99

I_1- C2 Mc 1GGAa- C2z`2vX _2;Bbi2` BM /2b+`BTiBpX HMM; mBbiB+b M/ HB
I_A"1 @oAGG1: a- Pba+bbtd 2bXB/M aQ+XBQ?2B-M; m B b i B +m i Q M - RNddX TX RNd k

