Linear Search | Binary Search CSIS-2420

Learning Outcomes:

- Use the internet to learn about linear and binary search
- Understand and implement linear search and binary search
- Review 1410 concepts like file-I/O and generic methods
- Write well structured code and avoid code repetition by using private method
- Choose descriptive names for both variables and methods

Turning In:

Create a jar file that includes all source code files as well as the text file.

Turn it in via Canvas

Description:

In this assignment you are going to write a class called Search.java, which includes the implementations of the binary search and the linear search algorithms.

You are also going to write a test client (SearchApp.java) to test the methods.

Requirements:

- Search.java:

  Class Search includes 2 methods: `linear` and `binary`
  - Both methods are static
  - Both are generic methods

    Hint: you'll need to restricgt the type parameter in order to be able to compare elements
  - Both have exactly 2 arguments: the array and the element to look for
  - Both methods return a value of type int.

    If the element was found the index is returned.

    Otherwise the methods return `-1`
  - One restriction: NO recursion (you can't call the method in its own method body)

- SearchApp.java:

  In order to test the two search methods the following needs to be done:
  - Read the words from the file `ThreeLetterWords.txt`

    Include the text file in your Java project and use NO absolute paths (they won't work on my computer)

    FYI: I got these words from the tournament word list
  - Test linear search with integer arrays
    - Create 3 integer arrays of size 5, 10, and 15
    - Fill them with random 2-digit numbers
    - Look for values that are included in 2 of the 3 arrays (one array should return -1)

      Use the parameterized constructor of class Random and pass a seed.

      This way you will always get the same sequence of numbers *(FYI: I used 17 as my seed)*
  - Test linear search with String arrays
    - Create 3 String arrays of size 5, 10, and 15
    - Fill it with random three letter words from the file
    - Look for values that are included in 2 of the 3 arrays (one array should return -1)

      Use the same seeded instance of Random that you created already
  - Do something analogous to test binary search

    Remember: Binary search only works on sorted arrays
  - At the end print all the words that were read in from the file – 20 words per line

Sample Output:

```
Test linear search with integer arrays:
[16, 40, 74, 66, 92]  key: 85 index: -1
[43, 14, 85, 62, 28, 53, 55, 50, 31, 88]  key: 85 index: 2
[88, 77, 73, 83, 87, 87, 67, 19, 60, 98, 87, 70, 85, 34, 60]  key: 85 index: 12

Test linear search with word arrays:
[HAM, LAS, RAW, SIX, YAY]  key: HAM index: 0
[ABO, GEE, RAP, DUG, TUN, NOW, KAB, FOY, ORB, ICY]  key: WAY index: -1
[ASP, ZIP, VAR, YOM, PEA, ESS, OOH, KIF, LAM, KOS, RYE, DAN, ABA, WAY, NEB]  key: WAY index: 13

Test binary search with integer arrays:
[27, 42, 43, 57, 68]  key: 68 index: 4
[11, 12, 25, 28, 40, 52, 66, 69, 81, 89]  key: 68 index: -1
[13, 30, 30, 32, 32, 33, 37, 38, 47, 50, 66, 68, 71, 78, 88]  key: 68 index: 11

Test  binary search with word arrays:
[CAN, HUG, LIP, VIA, WUD]  key: VIA index: 3
[ANI, COO, KAB, MOD, PAW, PIC, POP, SHE, SKY, WOG]  key: WAY index: -1
[ADZ, AUK, CAP, DIP, DUH, FIL, HEY, MET, MHO, NAG, POX, RAG, TED, TET, YUK]  key: CAP index: 2

Words from file:
AAH AAL AAS ABA ABO ABS ABY ACE ACT ADD ADO ADS ADZ AFF AFT AGA AGE AGO AGS AHA
AHI AHS AID AIL AIM AIN AIR AIS AIT ALA ALB ALE ALL ALP ALS ALT AMA AMI AMP AMU
ANA AND ANE ANI ANT ANY APE APO APP APT ARB ARC ARE ARF ARK ARM ARS ART ASH ASK
ASP ASS ATE ATT AUK AVA AVE AVO AWA AWE AWL AWN AXE AYE AYS AZO BAA BAD BAG BAH
BAL BAM BAN BAP BAR BAS BAT BAY BED BEE BEG BEL BEN BES BET BEY BIB BID BIG BIN
BIO BIS BIT BIZ BOA BOB BOD BOG BOO BOP BOS BOT BOW BOX BOY BRA BRO BRR BUB BUD
BUG BUM BUN BUR BUS BUT BUY BYE BYS CAB CAD CAM CAN CAP CAR CAT CAW CAY CEE CEL
CEP CHI CIG CIS COB COD COG COL CON COO COP COR COS COT COW COX COY COZ CRU CRY
CUB CUD CUE CUM CUP CUR CUT CWM DAB DAD DAG DAH DAK DAL DAM DAN DAP DAW DAY DEB
DEE DEF DEL DEN DEV DEW DEX DEY DIB DID DIE DIF DIG DIM DIN DIP DIS DIT DOC DOE
DOG DOL DOM DON DOR DOS DOT DOW DRY DUB DUD DUE DUG DUH DUI DUN DUO DUP DYE EAR
EAT EAU EBB ECU EDH EDS EEK EEL EFF EFS EFT EGG EGO EKE ELD ELF ELK ELL ELM ELS
EME EMS EMU END ENG ENS EON ERA ERE ERG ERN ERR ERS ESS ETA ETH EVE EWE EYE FAB
FAD FAG FAN FAR FAS FAT FAX FAY FED FEE FEH FEM FEN FER FES FET FEU FEW FEY FEZ
FIB FID FIE FIG FIL FIN FIR FIT FIX FIZ FLU FLY FOB FOE FOG FOH FON FOP FOR FOU
FOX FOY FRO FRY FUB FUD FUG FUN FUR GAB GAD GAE GAG GAL GAM GAN GAP GAR GAS GAT
GAY GED GEE GEL GEM GEN GET GEY GHI GIB GID GIE GIG GIN GIP GIT GNU GOA GOB GOD
GOO GOR GOS GOT GOX GOY GUL GUM GUN GUT GUV GUY GYM GYP HAD HAE HAG HAH HAJ HAM
HAO HAP HAS HAT HAW HAY HEH HEM HEN HEP HER HES HET HEW HEX HEY HIC HID HIE HIM
HIN HIP HIS HIT HMM HOB HOD HOE HOG HON HOP HOS HOT HOW HOY HUB HUE HUG HUH HUM
HUN HUP HUT HYP ICE ICH ICK ICY IDS IFF IFS IGG ILK ILL IMP INK INN INS ION IRE
IRK ISM ITS IVY JAB JAG JAM JAR JAW JAY JEE JET JEU JEW JIB JIG JIN JOB JOE JOG
JOT JOW JOY JUG JUN JUS JUT KAB KAE KAF KAS KAT KAY KEA KEF KEG KEN KEP KEX KEY
KHI KID KIF KIN KIP KIR KIS KIT KOA KOB KOI KOP KOR KOS KUE KYE LAB LAC LAD LAG
LAM LAP LAR LAS LAT LAV LAW LAX LAY LEA LED LEE LEG LEI LEK LES LET LEU LEV LEX
LEY LEZ LIB LID LIE LIN LIP LIS LIT LOB LOG LOO LOP LOT LOW LOX LUG LUM LUV LUX
LYE MAC MAD MAE MAG MAN MAP MAR MAS MAT MAW MAX MAY MED MEG MEL MEM MEN MET MEW
MHO MIB MIC MID MIG MIL MIM MIR MIS MIX MOA MOB MOC MOD MOG MOL MOM MON MOO MOP
MOR MOS MOT MOW MUD MUG MUM MUN MUS MUT MYC NAB NAE NAG NAH NAM NAN NAP NAW NAY
NEB NEE NEG NET NEW NIB NIL NIM NIP NIT NIX NOB NOD NOG NOH NOM NOO NOR NOS NOT
NOW NTH NUB NUN NUS NUT OAF OAK OAR OAT OBA OBE OBI OCA ODA ODD ODE ODS OES OFF
OFT OHM OHO OHS OIL OKA OKE OLD OLE OMS ONE ONO ONS OOH OOT OPE OPS OPT ORA ORB
ORC ORE ORS ORT OSE OUD OUR OUT OVA OWE OWL OWN OXO OXY PAC PAD PAH PAL PAM PAN
PAP PAR PAS PAT PAW PAX PAY PEA PEC PED PEE PEG PEH PEN PEP PER PES PET PEW PHI
PHT PIA PIC PIE PIG PIN PIP PIS PIT PIU PIX PLY POD POH POI POL POM POO POP POT
POW POX PRO PRY PSI PST PUB PUD PUG PUL PUN PUP PUR PUS PUT PYA PYE PYX QAT QIS
QUA RAD RAG RAH RAI RAJ RAM RAN RAP RAS RAT RAW RAX RAY REB REC RED REE REF REG
REI REM REP RES RET REV REX RHO RIA RIB RID RIF RIG RIM RIN RIP ROB ROC ROD ROE
ROM ROT ROW RUB RUE RUG RUM RUN RUT RYA RYE SAB SAC SAD SAE SAG SAL SAP SAT SAU
SAW SAX SAY SEA SEC SEE SEG SEI SEL SEN SER SET SEW SEX SHA SHE SHH SHY SIB SIC
SIM SIN SIP SIR SIS SIT SIX SKA SKI SKY SLY SOB SOD SOL SOM SON SOP SOS SOT SOU
SOW SOX SOY SPA SPY SRI STY SUB SUE SUK SUM SUN SUP SUQ SYN TAB TAD TAE TAG TAJ
TAM TAN TAO TAP TAR TAS TAT TAU TAV TAW TAX TEA TED TEE TEG TEL TEN TET TEW THE
THO THY TIC TIE TIL TIN TIP TIS TIT TOD TOE TOG TOM TON TOO TOP TOR TOT TOW TOY
TRY TSK TUB TUG TUI TUN TUP TUT TUX TWA TWO TYE UDO UGH UKE ULU UMM UMP UNS UPO
UPS URB URD URN URP USE UTA UTE UTS VAC VAN VAR VAS VAT VAU VAV VAW VEE VEG VET
VEX VIA VID VIE VIG VIM VIS VOE VOW VOX VUG VUM WAB WAD WAE WAG WAN WAP WAR WAS
WAT WAW WAX WAY WEB WED WEE WEN WET WHA WHO WHY WIG WIN WIS WIT WIZ WOE WOG WOK
WON WOO WOP WOS WOT WOW WRY WUD WYE WYN XIS YAG YAH YAK YAM YAP YAR YAW YAY YEA
YEH YEN YEP YES YET YEW YID YIN YIP YOB YOD YOK YOM YON YOU YOW YUK YUM YUP ZAG
ZAP ZAS ZAX ZED ZEE ZEK ZEP ZIG ZIN ZIP ZIT ZOA ZOO ZUZ ZZZ
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