CSE 101 : Introduction to Computers

Lecture 2

Python and Pycharm installation

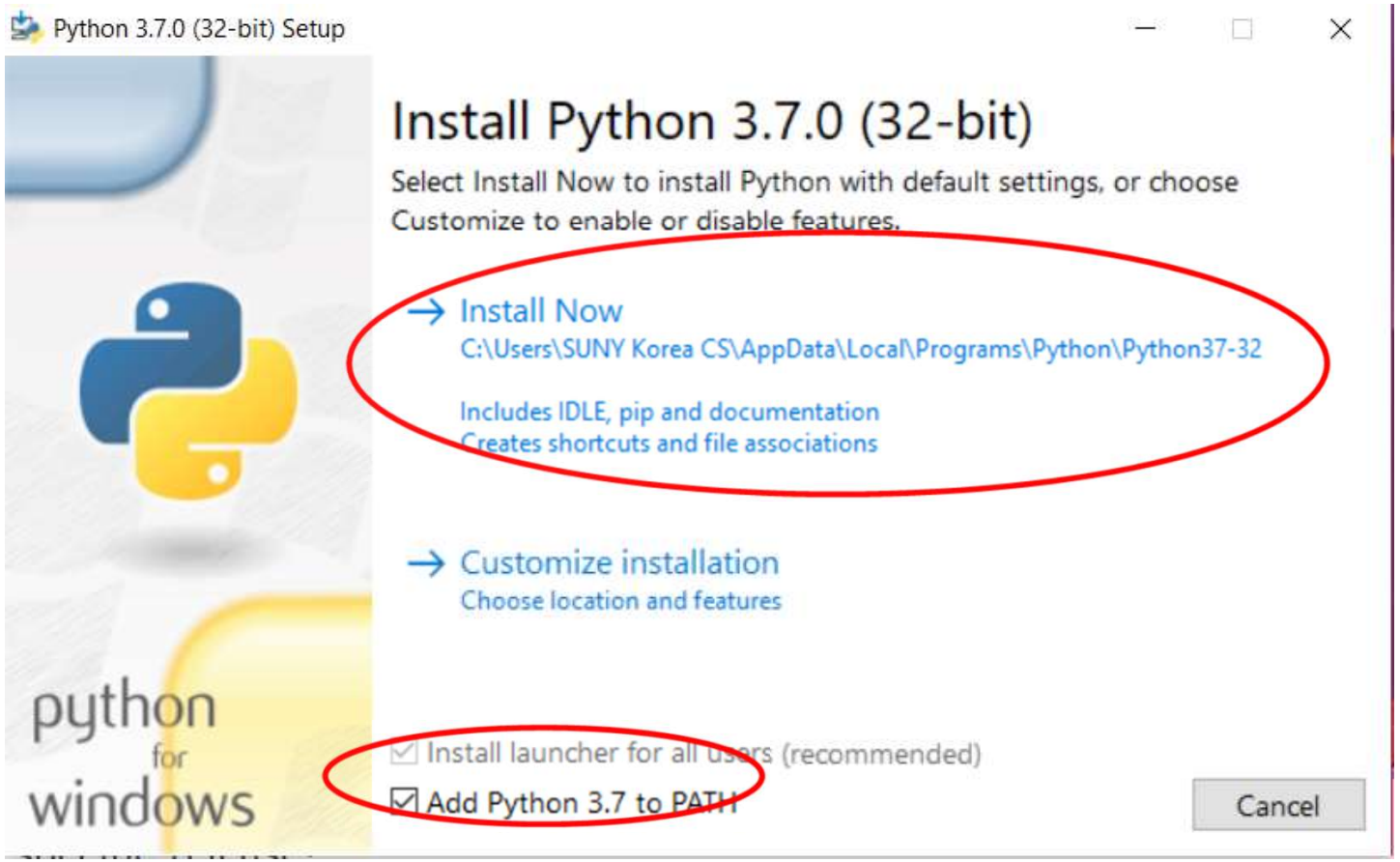
Quiz 1 based on Homework

Computational Thinking – Text Chapter 1

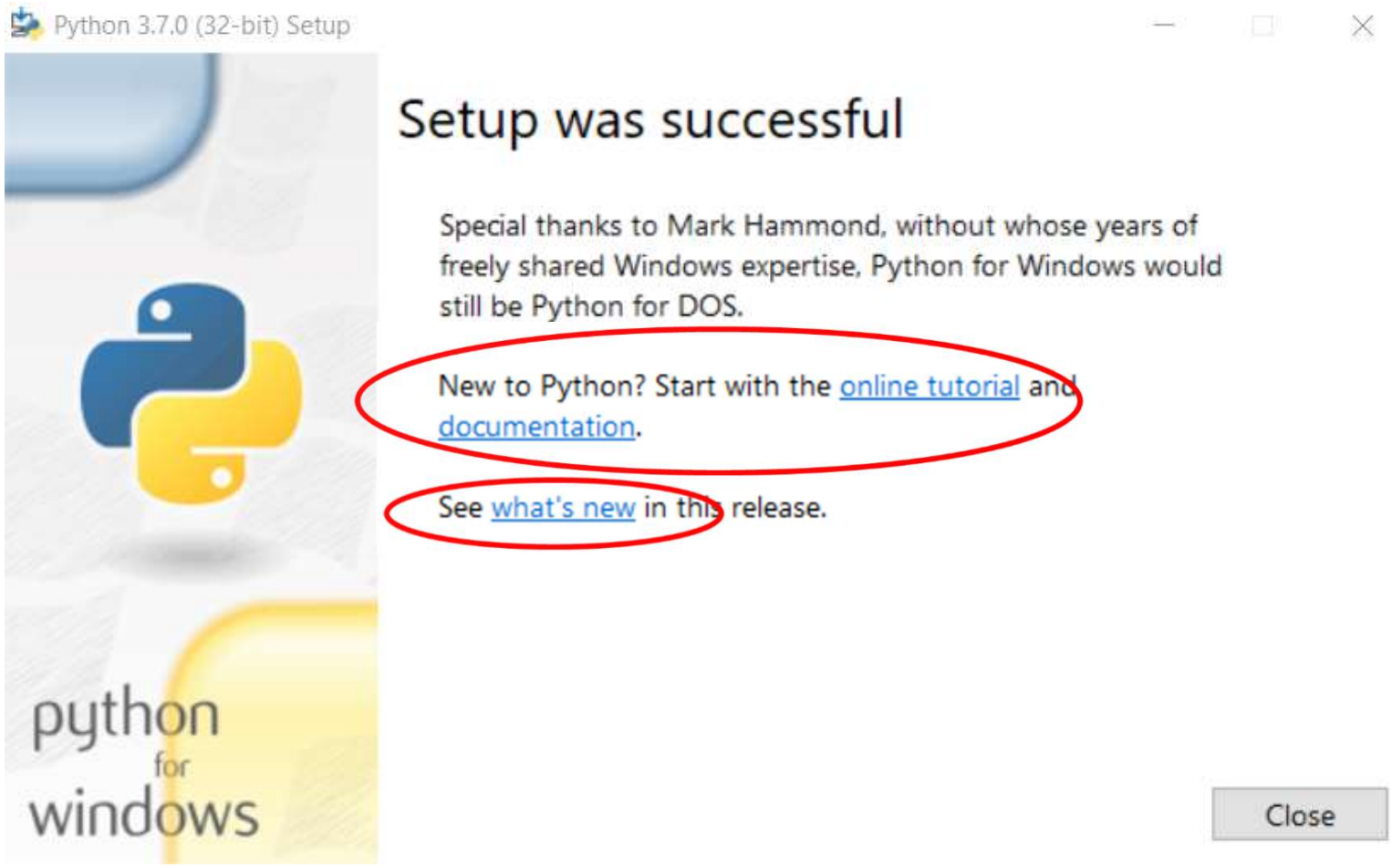
Python Installation

- https://www.python.org/downloads/

Python Installation

- 

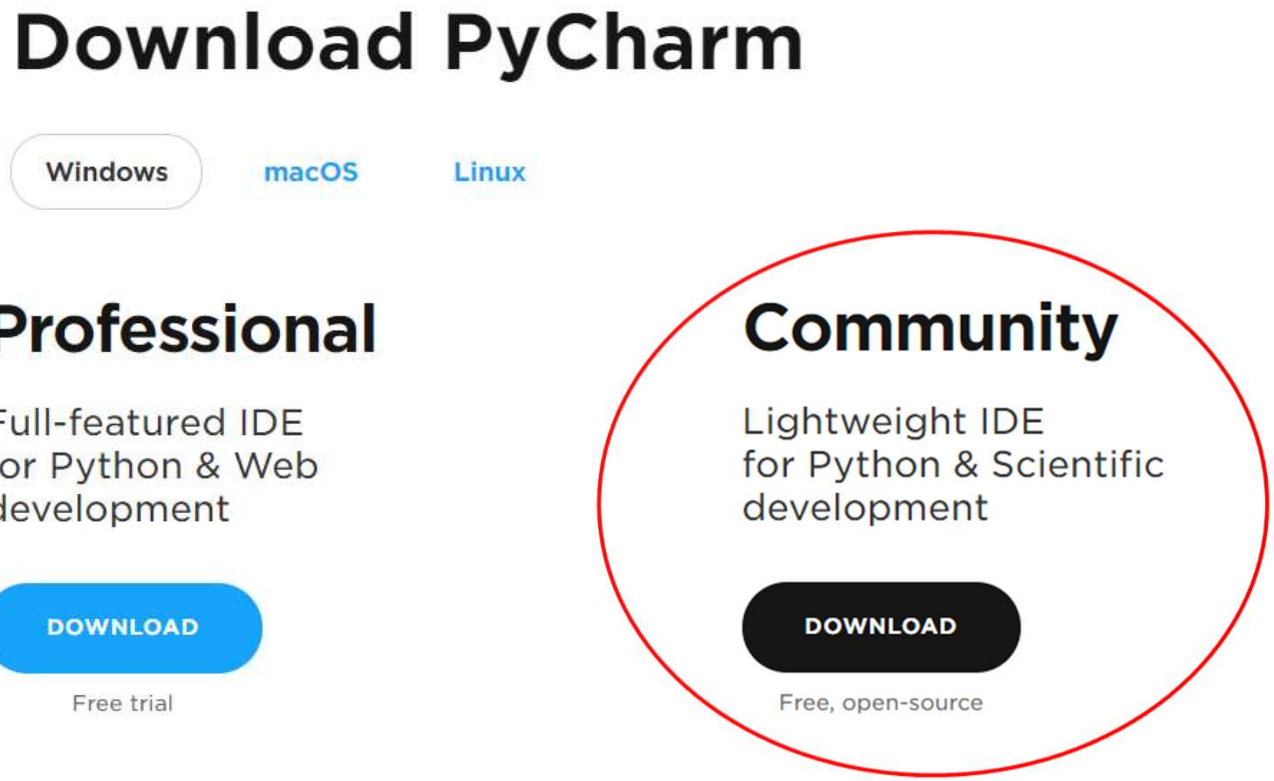
Python Installation



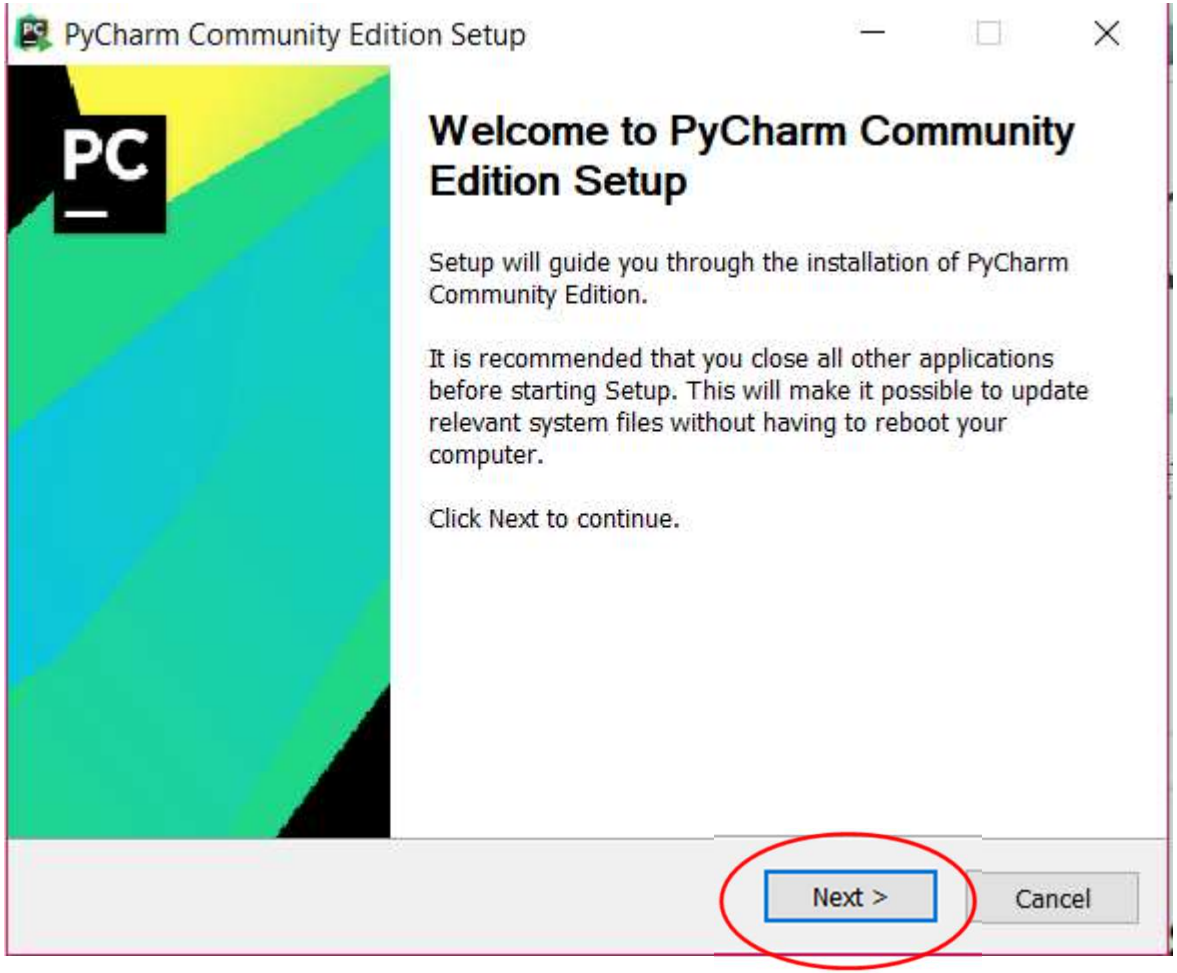
```
Python 3.7 (32-bit)
Python 3.7.0 (v3.7.0:1bf9cc5093, Jun 27 2018, 04:06:47) [MSC v.1914 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> print ("helloworld")
helloworld
>>> 1 + 1
2
>>> a = 1;
>>> b = 2;
>>> a + b
3
>>> name = "SUNY"
>>> country = "Korea"
>>> print (name + country)
SUNYKorea
>>> print (name + " " + country)
SUNY Korea
>>> pi = 22/7
>>> pi
3.142857142857143
>>> print type(a)
  File "<stdin>", line 1
    print type(a)
              ^
SyntaxError: invalid syntax
>>> print (type(a))
<class 'int'>
>>> print(type(name)
... )
<class 'str'>
>>> print(type(pi))
<class 'float'>
>>>
```

PyCharm Installation

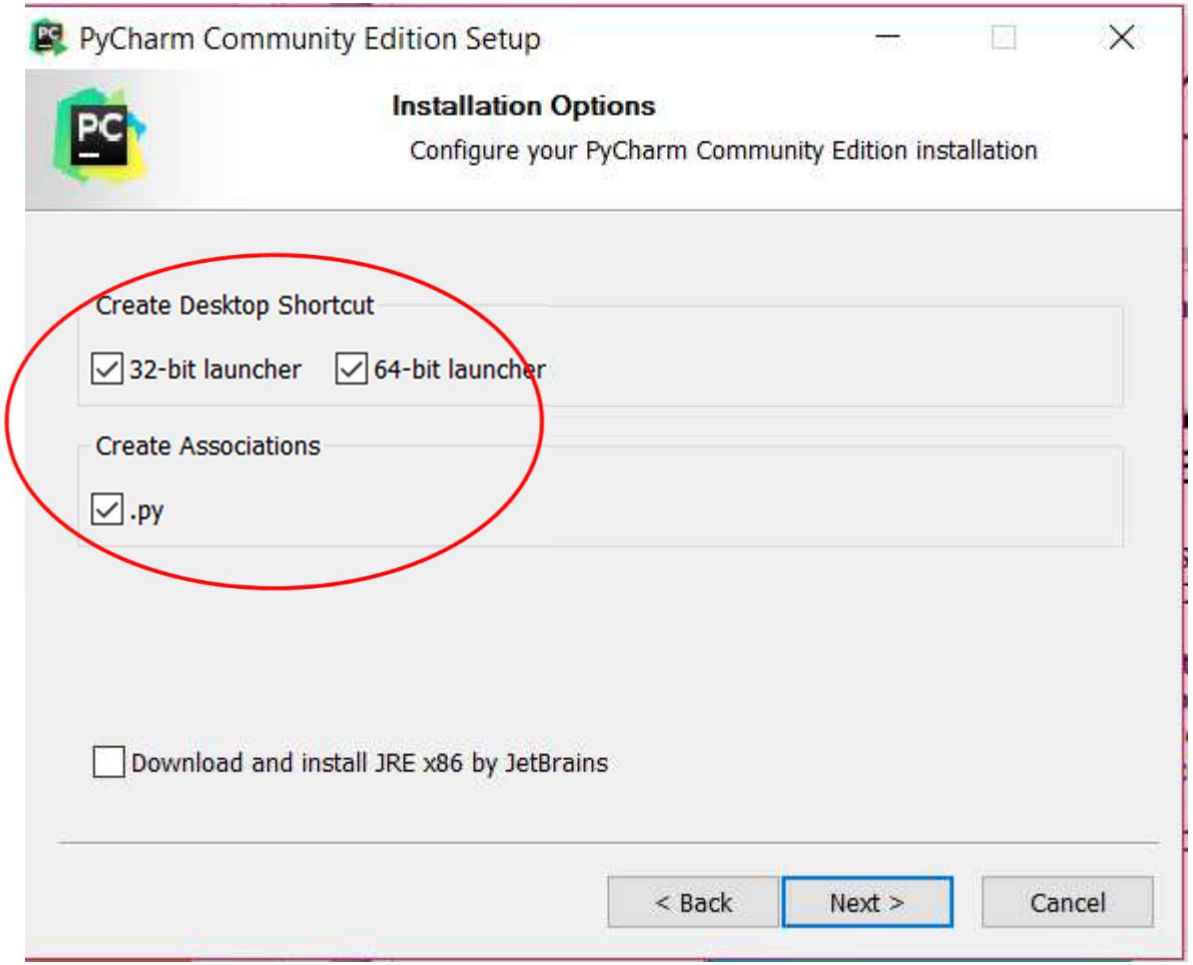
- https://www.jetbrains.com/pycharm/download/#section=windows



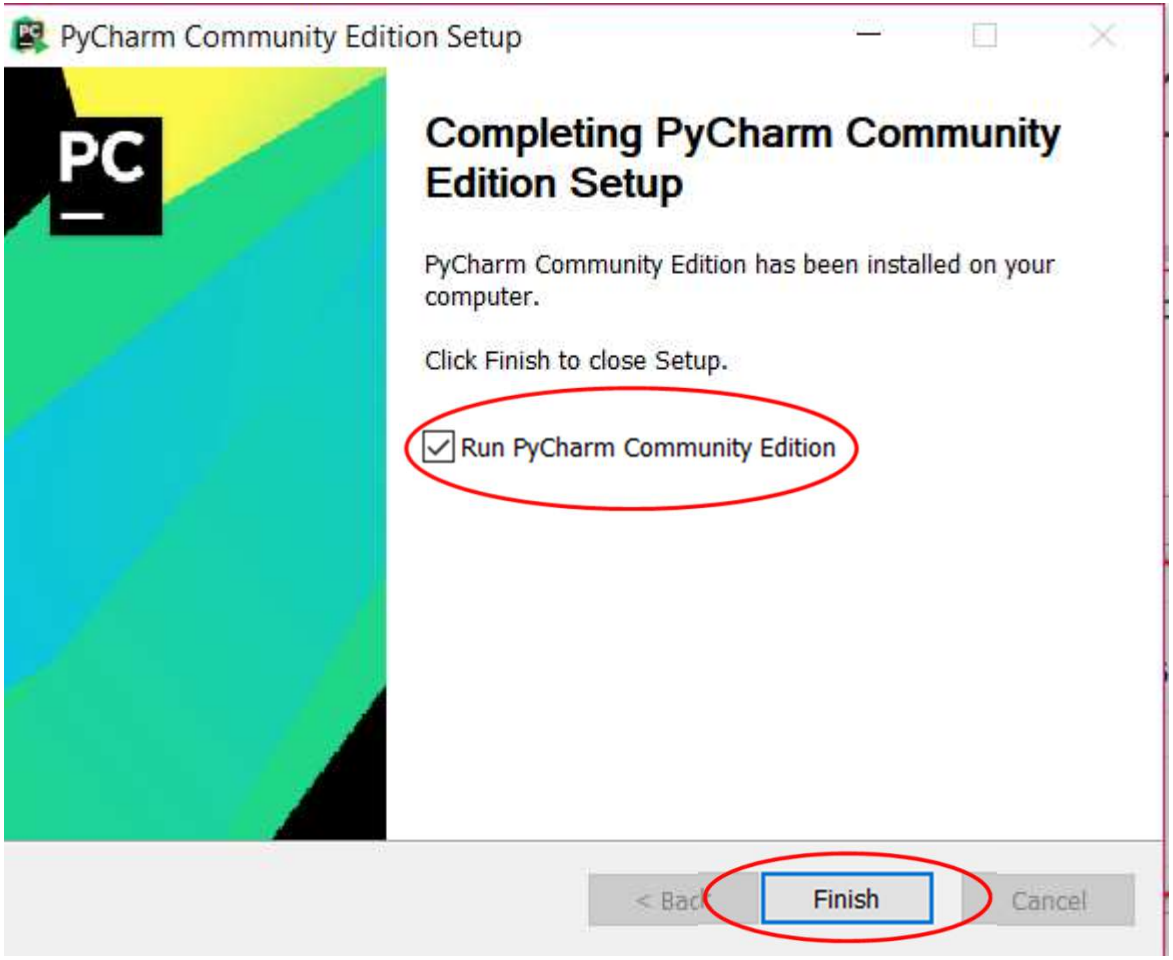
PyCharm Installation



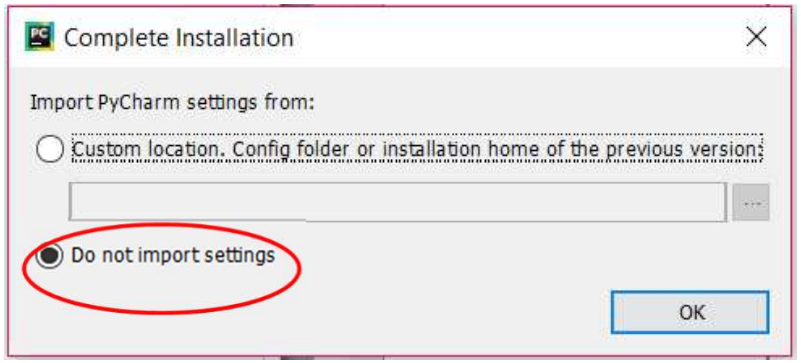
PyCharm Installation

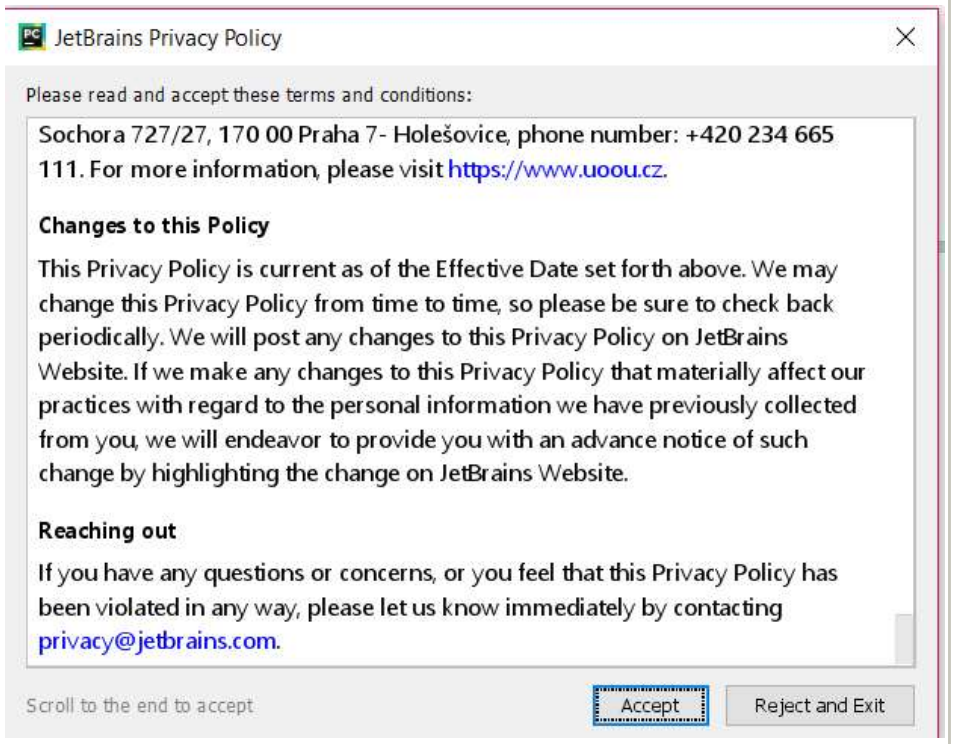


PyCharm Installation

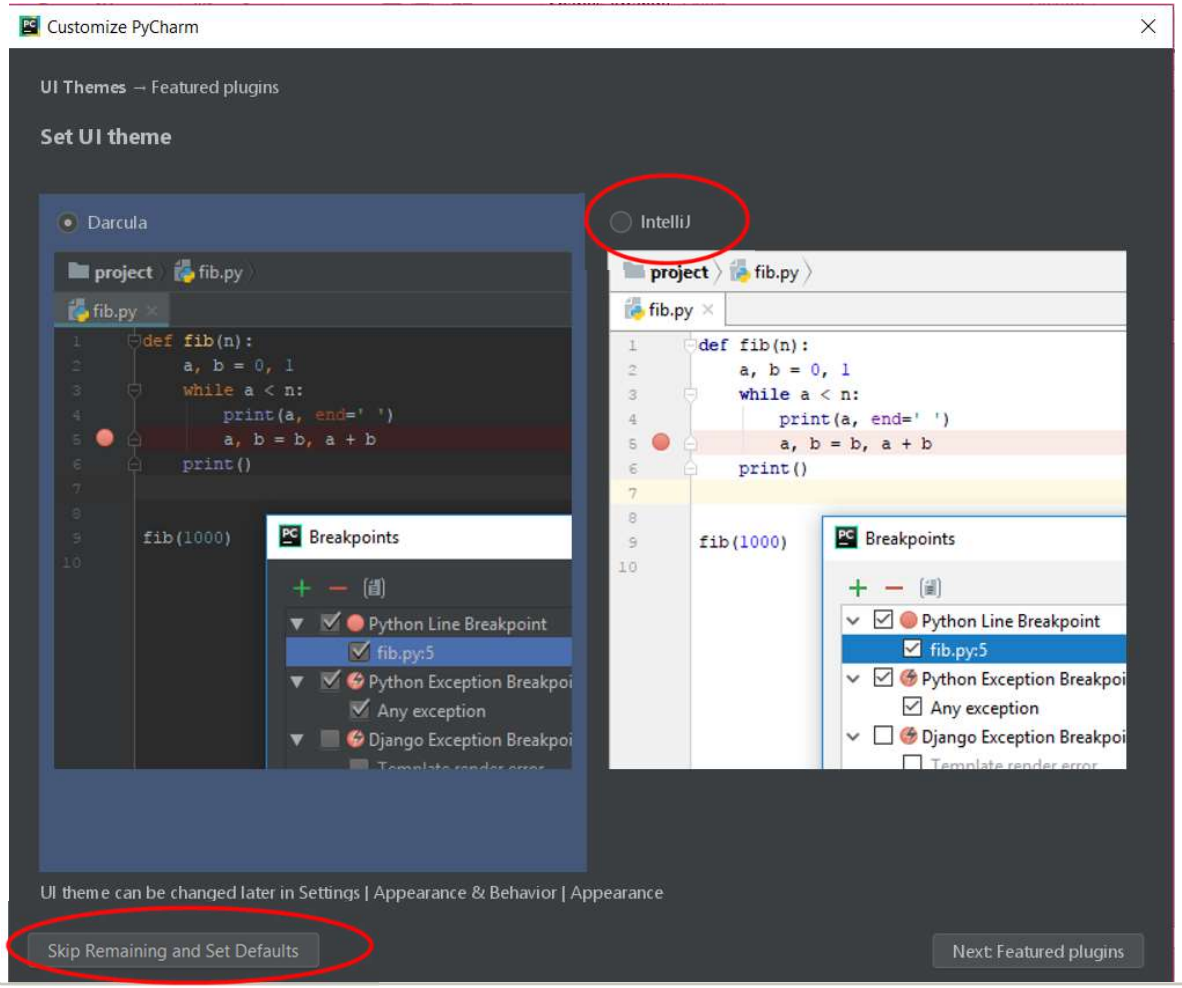


PyCharm Installation

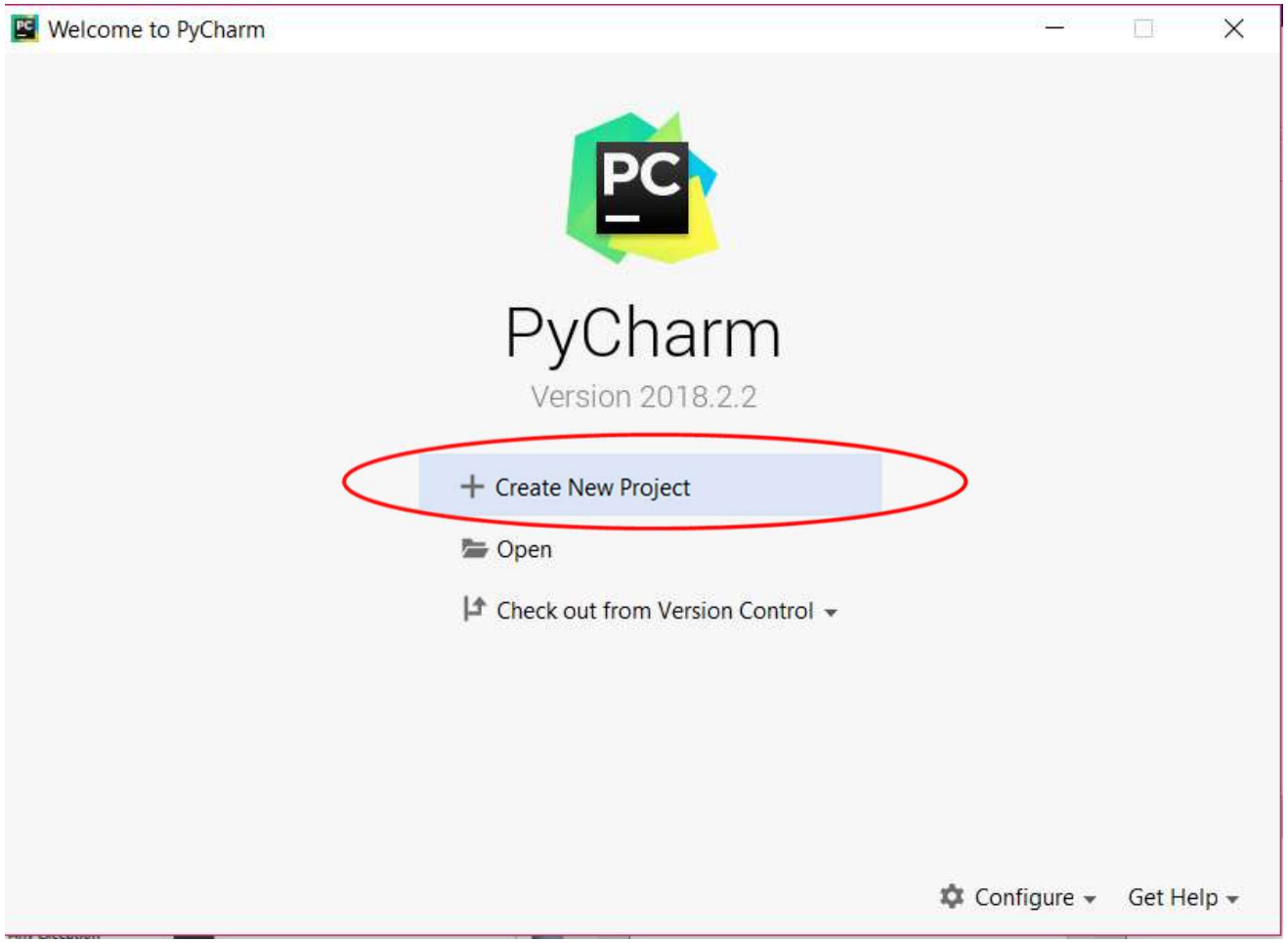




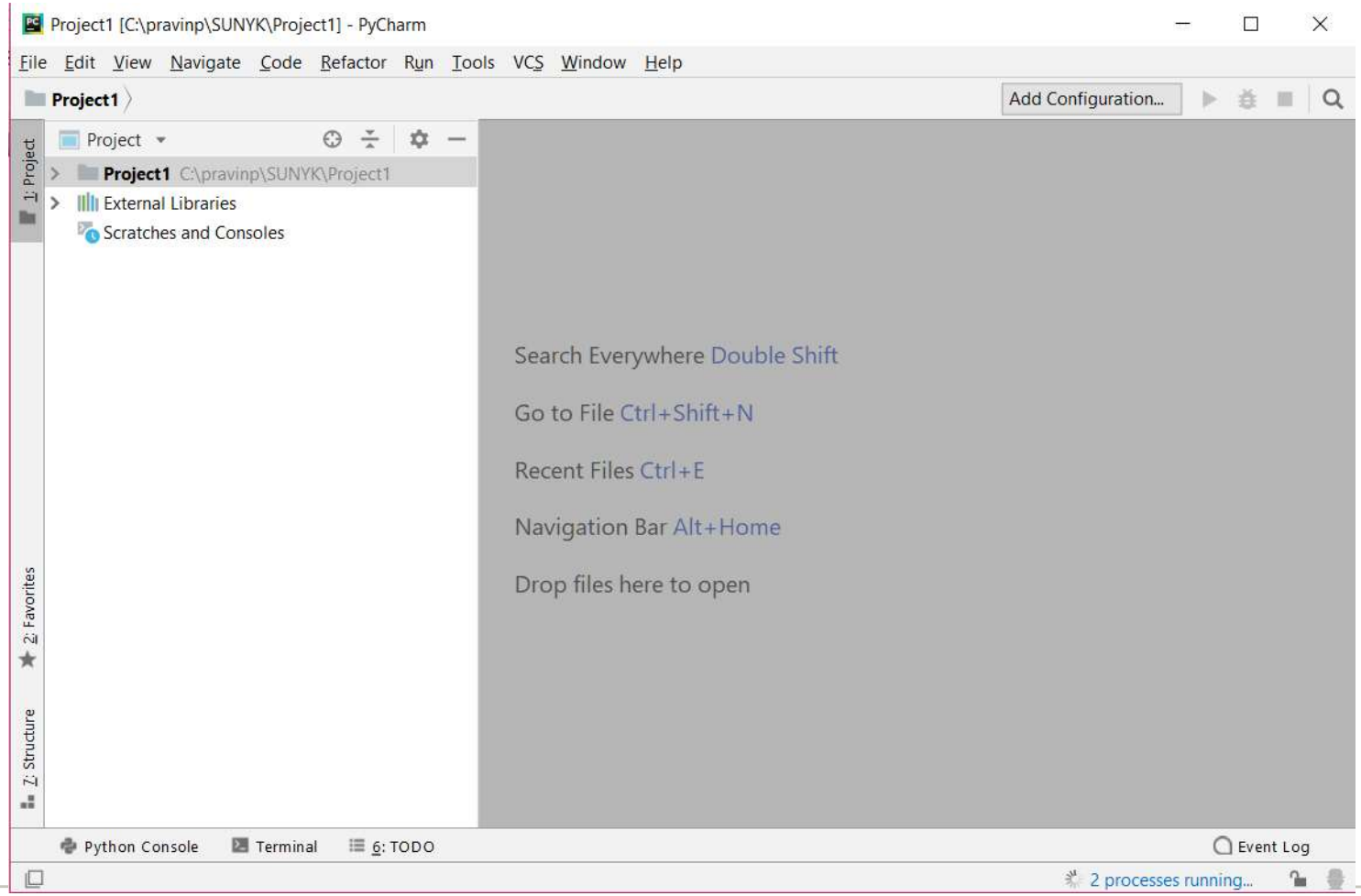
PyCharm Installation



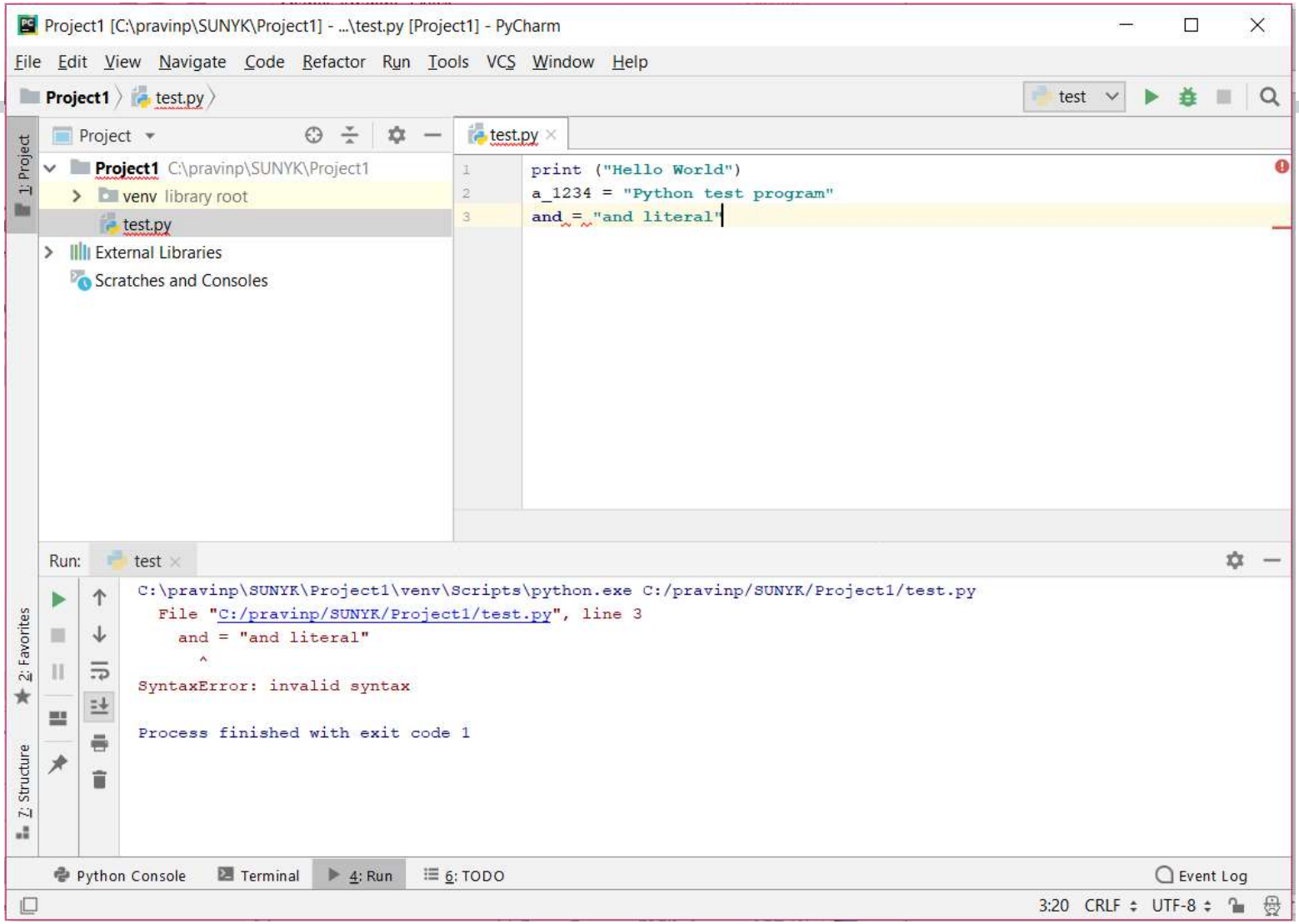
PyCharm Project



PyCharm IDE


Project1 [C:\pravinp\SUNYK\Project1] - PyCharm
File Edit View Navigate Code Refactor Run Tools VCS Window Help
Project1
Add Configuration...
Project
Project1 C:\pravinp\SUNYK\Project1
External Libraries
Scratches and Consoles
Search Everywhere Double Shift
Go to File Ctrl+Shift+N
Recent Files Ctrl+E
Navigation Bar Alt+Home
Drop files here to open
1: Project
2: Favorites
7: Structure
Python Console
Terminal
6: TODO
Event Log
2 processes running...

PyCharm IDE


Project1 [C:\pravinp\SUNYK\Project1] - ...\test.py [Project1] - PyCharm
File Edit View Navigate Code Refactor Run Tools VCS Window Help
Project1 test.py
test
Project
Project1 C:\pravinp\SUNYK\Project1
venv library root
test.py
External Libraries
Scratches and Consoles
test.py
1 print ("Hello World")
2 a_1234 = "Python test program"
3 and = "and literal"
Run: test
C:\pravinp\SUNYK\Project1\venv\Scripts\python.exe C:/pravinp/SUNYK/Project1/test.py
File "C:/pravinp/SUNYK/Project1/test.py", line 3
and = "and literal"
^
SyntaxError: invalid syntax
Process finished with exit code 1
1: Project
2: Favorites
7: Structure
Python Console
Terminal
4: Run
6: TODO
Event Log
3:20 CRLF UTF-8

Python variable names

- Can contain letters, numbers, and underscores
- Must begin with a letter
- Cannot be one of the reserved Python keywords: and, as, assert, break, class, continue, def, del, elif, else, except, exec, finally, for, from, global, if, import, in, is, lambda, not, or, pass, print, raise, return, try, while, with, yield

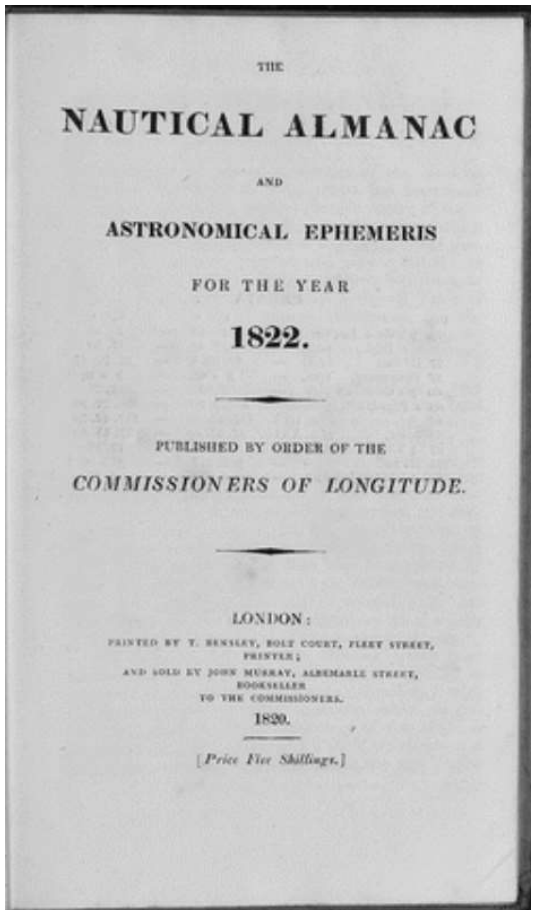
Python Operators

- + addition
- - subtraction
- / division
- ** exponentiation
- % modulus (remainder after division)
- Comparison operators (coming up)

Quiz 1

- Surveymonkey
- 10 mins time
- Quiz result available immediately

Explorations in Computing
Chapter 1 - Introduction


THE

NAUTICAL ALMANAC

AND

ASTRONOMICAL EPHEMERIS

FOR THE YEAR

1822.

PUBLISHED BY ORDER OF THE

COMMISSIONERS OF LONGITUDE.

LONDON:

PRINTED BY T. BENSLEY, BOLT COURT, FLEET STREET, PRINTER;

AND SOLD BY JOHN MURRAY, ALBEMARLE STREET, BOOKSELLER TO THE COMMISSIONERS.

1820.

[Price Five Shillings.]

- Summer of 1821 – Mathematician Charles Babbage and astronomer John Herschel were working on creating a book of mathematical tables.
- Almanac contains tables denoting positions of the Moons, planets and stars – which are used by navigators to determine location at the sea.
- Manual work caused a number of errors.
- Babbage showed his frustration with the large number of errors by exclaiming, "I wish to God these calculations had been executed by steam!"
- What made Babbage think steam engines could help him solve mathematical problems?

UT	ARIES	VENUS −3.9		MARS +1.7		JUPITER −2.0		SATURN +0.1		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
10 00	227 37.2	151 33.2	N23 58.3	151 02.2	N23 44.9	124 05.5	N23 04.8	154 11.5	N21 13.0	Acamar	315 25.3	S40 17.8
01	242 39.7	166 32.3	58.7	166 02.9	45.1	139 07.5	04.7	169 13.6	13.1	Achernar	335 33.7	S57 13.5
02	257 42.1	181 31.5	59.1	181 03.5	45.3	154 09.5	04.7	184 15.8	13.1	Acrux	173 18.8	S63 06.9
03	272 44.6	196 30.7	. . 59.5	196 04.2	. . 45.4	169 11.5	. . 04.7	199 17.9	. . 13.1	Adhara	255 19.7	S28 58.7
04	287 47.1	211 29.9	23 59.9	211 04.8	45.6	184 13.5	04.6	214 20.1	13.2	Aldebaran	290 59.8	N16 30.8
05	302 49.5	226 29.1	24 00.3	226 05.5	45.8	199 15.5	04.6	229 22.2	13.2			
06	317 52.0	241 28.3	N24 00.6	241 06.1	N23 45.9	214 17.5	N23 04.5	244 24.3	N21 13.3	Alioth	166 27.8	N55 57.1
07	332 54.4	256 27.5	01.0	256 06.8	46.1	229 19.4	04.5	259 26.5	13.3	Alkaid	153 05.2	N49 18.2
08	347 56.9	271 26.6	01.4	271 07.4	46.3	244 21.4	04.5	274 28.6	13.3	Al Na'ir	27 54.7	S46 56.9
09	2 59.4	286 25.8	. . 01.8	286 08.1	. . 46.4	259 23.4	. . 04.4	289 30.8	. . 13.4	Alnilam	275 55.6	S 1 12.1
10	18 01.8	301 25.0	02.2	301 08.7	46.6	274 25.4	04.4	304 32.9	13.4	Alphard	218 04.7	S 8 40.2
11	33 04.3	316 24.2	02.5	316 09.4	46.8	289 27.4	04.4	319 35.0	13.5			
12	48 06.8	331 23.4	N24 02.9	331 10.0	N23 46.9	304 29.4	N23 04.3	334 37.2	N21 13.5	Alphecca	126 18.0	N26 42.4
13	63 09.2	346 22.6	03.3	346 10.7	47.1	319 31.4	04.3	349 39.3	13.5	Alpheratz	357 52.9	N29 05.9
14	78 11.7	1 21.7	03.7	1 11.3	47.3	334 33.4	04.2	4 41.4	13.6	Altair	62 16.6	N 8 52.3
15	93 14.2	16 20.9	. . 04.0	16 12.0	. . 47.4	349 35.4	. . 04.2	19 43.6	. . 13.6	Ankaa	353 24.6	S42 17.6
16	108 16.6	31 20.1	04.4	31 12.6	47.6	4 37.4	04.2	34 45.7	13.7	Antares	112 36.7	S26 26.2
17	123 19.1	46 19.3	04.8	46 13.3	47.7	19 39.4	04.1	49 47.9	13.7			
18	138 21.5	61 18.5	N24 05.1	61 13.9	N23 47.9	34 41.3	N23 04.1	64 50.0	N21 13.7	Arcturus	146 03.4	N19 10.3
19	153 24.0	76 17.6	05.5	76 14.6	48.1	49 43.3	04.1	79 52.1	13.8	Atria	107 46.0	S69 01.8
20	168 26.5	91 16.8	05.9	91 15.2	48.2	64 45.3	04.0	94 54.3	13.8	Avior	234 21.9	S59 31.3
21	183 28.9	106 16.0	. . 06.2	106 15.9	. . 48.4	79 47.3	. . 04.0	109 56.4	. . 13.9	Bellatrix	278 41.7	N 6 21.0
22	198 31.4	121 15.2	06.6	121 16.5	48.6	94 49.3	03.9	124 58.6	13.9	Betelgeuse	271 11.1	N 7 24.4
23	213 33.9	136 14.4	07.0	136 17.1	48.7	109 51.3	03.9	140 00.7	13.9			
11 00	228 36.3	151 13.5	N24 07.3	151 17.8	N23 48.9	124 53.3	N23 03.9	155 02.8	N21 14.0	Canopus	264 00.4	S52 42.0
01	243 38.8	166 12.7	07.7	166 18.4	49.0	139 55.3	03.8	170 05.0	14.0	Capella	280 47.9	N46 00.1
02	258 41.3	181 11.9	08.0	181 19.1	49.2	154 57.3	03.8	185 07.1	14.1	Deneb	49 37.4	N45 16.9
03	273 43.7	196 11.1	. . 08.4	196 19.7	. . 49.4	169 59.3	. . 03.7	200 09.3	. . 14.1	Denebola	182 42.4	N14 33.6
04	288 46.2	211 10.3	08.8	211 20.4	49.5	185 01.2	03.7	215 11.4	14.1	Diphda	349 04.9	S17 58.6
05	303 48.7	226 09.4	09.1	226 21.0	49.7	200 03.2	03.7	230 13.5	14.2			
06	318 51.1	241 08.6	N24 09.5	241 21.7	N23 49.8	215 05.2	N23 03.6	245 15.7	N21 14.2	Dubhe	194 01.9	N61 44.6
07	333 53.6	256 07.8	09.8	256 22.3	50.0	230 07.2	03.6	260 17.8	14.3	Elnath	278 24.1	N28 36.6
08	348 56.0	271 07.0	10.2	271 23.0	50.1	245 09.2	03.6	275 19.9	14.3	Eltanin	90 49.8	N51 29.1
09	3 58.5	286 06.2	. . 10.5	286 23.6	. . 50.3	260 11.2	. . 03.5	290 22.1	. . 14.3	Enif	33 55.8	N 9 52.9
10	19 01.0	301 05.3	10.9	301 24.3	50.5	275 13.2	03.5	305 24.2	14.4	Fomalhaut	15 33.7	S29 36.6
11	34 03.4	316 04.5	11.2	316 24.9	50.6	290 15.2	03.4	320 26.4	14.4			
12	49 05.9	331 03.7	N24 11.6	331 25.6	N23 50.8	305 17.1	N23 03.4	335 28.5	N21 14.5	Gacrux	172 10.5	S57 07.7
13	64 08.4	346 02.9	11.9	346 26.2	50.9	320 19.1	03.4	350 30.6	14.5	Gienah	176 01.1	S17 33.3
14	79 10.8	1 02.0	12.3	1 26.9	51.1	335 21.1	03.3	5 32.8	14.5	Hadar	148 59.9	S60 23.1
15	94 13.3	16 01.2	. . 12.6	16 27.5	. . 51.2	350 23.1	. . 03.3	20 34.9	. . 14.6	Hamal	328 11.1	N23 28.2
16	109 15.8	31 00.4	12.9	31 28.2	51.4	5 25.1	03.2	35 37.1	14.6	Kaus Aust.	83 55.1	S34 23.0
17	124 18.2	45 59.6	13.3	46 28.8	51.5	20 27.1	03.2	50 39.2	14.7			
18	139 20.7	60 58.8	N24 13.6	61 29.5	N23 51.7	35 29.1	N23 03.2	65 41.3	N21 14.7	Kochab	137 18.2	N74 08.9
19	154 23.1	75 57.9	14.0	76 30.1	51.9	50 31.1	03.1	80 43.5	14.7	Markab	13 47.2	N15 12.8
20	169 25.6	90 57.1	14.3	91 30.8	52.0	65 33.0	03.1	95 45.6	14.8	Menkar	314 24.6	N 4 05.8
21	184 28.1	105 56.3	. . 14.6	106 31.4	. . 52.2	80 35.0	. . 03.0	110 47.7	. . 14.8	Menkent	148 17.6	S36 22.9
22	199 30.5	120 55.5	15.0	121 32.1	52.3	95 37.0	03.0	125 49.9	14.9	Miaplacidus	221 41.8	S69 43.8
23	214 33.0	135 54.6	15.3	136 32.7	52.5	110 39.0	03.0	140 52.0	14.9			
12 00	229 35.5	150 53.8	N24 15.6	151 33.4	N23 52.6	125 41.0	N23 02.9	155 54.2	N21 14.9	Mirfak	308 53.5	N49 52.1
01	244 37.9	165 53.0	16.0	166 34.0	52.8	140 43.0	02.9	170 56.3	15.0	Nunki	76 08.9	S26 17.6
02	259 40.4	180 52.2	16.3	181 34.7	52.9	155 45.0	02.9	185 58.4	15.0	Peacock	53 32.7	S56 43.5
03	274 42.9	195 51.3	. . 16.6	196 35.3	. . 53.1	170 46.9	. . 02.8	201 00.6	. . 15.0	Pollux	243 38.6	N28 01.4
04	289 45.3	210 50.5	17.0	211 35.9	53.2	185 48.9	02.8	216 02.7	15.1	Procyon	245 09.1	N 5 13.1
05	304 47.8	225 49.7	17.3	226 36.6	53.4	200 50.9	02.7	231 04.8	15.1			
06	319 50.3	240 48.9	N24 17.6	241 37.2	N23 53.5	215 52.9	N23 02.7	246 07.0	N21 15.2	Rasalhague	96 14.3	N12 33.4
07	334 52.7	255 48.0	17.9	256 37.9	53.7	230 54.9	02.7	261 09.1	15.2	Regulus	207 52.8	N11 57.4
08	349 55.2	270 47.2	18.3	271 38.5	53.8	245 56.9	02.6	276 11.2	15.2	Rigel	281 20.8	S 8 12.0
09	4 57.6	285 46.4	. . 18.6	286 39.2	. . 54.0	260 58.8	. . 02.6	291 13.4	. . 15.3	Rigil Kent.	140 03.3	S60 50.7
10	20 00.1	300 45.5	18.9	301 39.8	54.1	276 00.8	02.5	306 15.5	15.3	Sabik	102 22.3	S15 43.7
11	35 02.6	315 44.7	19.2	316 40.5	54.3	291 02.8	02.5	321 17.7	15.4			
12	50 05.0	330 43.9	N24 19.5	331 41.1	N23 54.4	306 04.8	N23 02.5	336 19.8	N21 15.4	Schedar	349 51.2	N56 32.7
13	65 07.5	345 43.1	19.9	346 41.8	54.6	321 06.8	02.4	351 21.9	15.4	Shaula	96 33.5	S37 06.3
14	80 10.0	0 42.2	20.2	1 42.4	54.7	336 08.8	02.4	6 24.1	15.5	Sirius	258 41.7	S16 43.3
15	95 12.4	15 41.4	. . 20.5	16 43.1	. . 54.8	351 10.7	. . 02.3	21 26.2	. . 15.5	Spica	158 40.2	S11 10.4
16	110 14.9	30 40.6	20.8	31 43.7	55.0	6 12.7	02.3	36 28.3	15.6	Suhail	222 59.0	S43 26.7
17	125 17.4	45 39.8	21.1	46 44.4	55.1	21 14.7	02.3	51 30.5	15.6			
18	140 19.8	60 38.9	N24 21.4	61 45.0	N23 55.3	36 16.7	N23 02.2	66 32.6	N21 15.6	Vega	80 44.6	N38 46.9
19	155 22.3	75 38.1	21.7	76 45.7	55.4	51 18.7	02.2	81 34.7	15.7	Zuben'ubi	137 14.8	S16 03.1
20	170 24.8	90 37.3	22.0	91 46.3	55.6	66 20.7	02.1	96 36.9	15.7		SHA	Mer. Pass.
21	185 27.2	105 36.4	. . 22.3	106 47.0	. . 55.7	81 22.6	. . 02.1	111 39.0	. . 15.8	Venus	282 37.2	13 56
22	200 29.7	120 35.6	22.6	121 47.6	55.9	96 24.6	02.1	126 41.2	15.8	Mars	282 41.5	13 54
23	215 32.1	135 34.8	23.0	136 48.3	56.0	111 26.6	02.0	141 43.3	15.8	Jupiter	256 17.0	15 38
	h m									Saturn	286 26.5	13 38
Mer. Pass.	0 44.1	v −0.8	d 0.3	v 0.6	d 0.2	v 2.0	d 0.0	v 2.1	d 0.0			

UT	SUN		MOON					Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 10	Moonrise 11	Moonrise 12	Moonrise 13
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
10 00	180 54.3	N17 31.0	205 56.8	16.1	N 4 25.8	12.5	54.4	N 72	▭	▭	▭	03 19	02 53	02 17	▭
01	195 54.3	31.6	220 31.9	16.1	4 38.3	12.4	54.4	N 70	////	////	01 25	03 26	03 08	02 45	02 06
02	210 54.3	32.3	235 07.0	16.0	4 50.7	12.5	54.4	68	////	////	02 10	03 31	03 20	03 06	02 47
03	225 54.3	. . 32.9	249 42.0	16.0	5 03.2	12.5	54.4	66	////	00 28	02 39	03 36	03 30	03 23	03 15
04	240 54.4	33.6	264 17.0	16.0	5 15.7	12.4	54.4	64	////	01 35	03 01	03 40	03 38	03 37	03 37
05	255 54.4	34.3	278 52.0	16.0	5 28.1	12.5	54.4	62	////	02 09	03 18	03 44	03 46	03 49	03 55
06	270 54.4	N17 34.9	293 27.0	15.9	N 5 40.6	12.4	54.5	60	00 25	02 33	03 33	03 47	03 52	03 59	04 09
07	285 54.4	35.6	308 01.9	15.9	5 53.0	12.4	54.5	N 58	01 25	02 52	03 45	03 50	03 58	04 08	04 22
08	300 54.5	36.2	322 36.8	15.8	6 05.4	12.4	54.5	56	01 56	03 07	03 55	03 52	04 03	04 16	04 32
09	315 54.5	. . 36.9	337 11.6	15.8	6 17.8	12.3	54.5	54	02 19	03 20	04 05	03 54	04 07	04 23	04 42
10	330 54.5	37.5	351 46.4	15.8	6 30.1	12.4	54.5	52	02 36	03 32	04 13	03 56	04 11	04 29	04 51
11	345 54.5	38.2	6 21.2	15.7	6 42.5	12.3	54.5	50	02 51	03 42	04 20	03 58	04 15	04 35	04 58
12	0 54.5	N17 38.8	20 55.9	15.7	N 6 54.8	12.3	54.5	45	03 20	04 02	04 36	04 02	04 23	04 47	05 15
13	15 54.6	39.5	35 30.6	15.7	7 07.1	12.3	54.5	N 40	03 42	04 19	04 49	04 06	04 30	04 57	05 28
14	30 54.6	40.2	50 05.3	15.6	7 19.4	12.3	54.6	35	03 59	04 32	05 00	04 09	04 36	05 06	05 40
15	45 54.6	. . 40.8	64 39.9	15.5	7 31.7	12.2	54.6	30	04 12	04 44	05 09	04 11	04 41	05 14	05 50
16	60 54.6	41.5	79 14.4	15.6	7 43.9	12.3	54.6	20	04 35	05 02	05 26	04 16	04 50	05 27	06 07
17	75 54.7	42.1	93 49.0	15.4	7 56.2	12.2	54.6	N 10	04 52	05 18	05 40	04 20	04 58	05 39	06 23
18	90 54.7	N17 42.8	108 23.4	15.5	N 8 08.4	12.1	54.6	0	05 06	05 31	05 53	04 24	05 06	05 50	06 37
19	105 54.7	43.4	122 57.9	15.4	8 20.5	12.2	54.6	S 10	05 18	05 44	06 06	04 28	05 14	06 01	06 52
20	120 54.7	44.1	137 32.3	15.3	8 32.7	12.1	54.6	20	05 30	05 56	06 20	04 32	05 22	06 13	07 07
21	135 54.7	. . 44.7	152 06.6	15.3	8 44.8	12.1	54.7	30	05 41	06 10	06 35	04 37	05 31	06 27	07 25
22	150 54.8	45.4	166 40.9	15.3	8 56.9	12.1	54.7	35	05 47	06 17	06 44	04 40	05 37	06 35	07 36
23	165 54.8	46.0	181 15.2	15.2	9 09.0	12.0	54.7	40	05 53	06 25	06 54	04 43	05 43	06 45	07 48
11 00	180 54.8	N17 46.6	195 49.4	15.2	N 9 21.0	12.0	54.7	45	05 59	06 35	07 06	04 46	05 50	06 56	08 02
01	195 54.8	47.3	210 23.6	15.1	9 33.0	12.0	54.7	S 50	06 06	06 46	07 21	04 51	05 59	07 09	08 20
02	210 54.8	47.9	224 57.7	15.0	9 45.0	11.9	54.7	52	06 09	06 50	07 28	04 53	06 03	07 15	08 28
03	225 54.9	. . 48.6	239 31.7	15.0	9 56.9	11.9	54.7	54	06 13	06 56	07 35	04 55	06 08	07 22	08 38
04	240 54.9	49.2	254 05.7	15.0	10 08.8	11.9	54.8	56	06 16	07 02	07 43	04 58	06 13	07 30	08 48
05	255 54.9	49.9	268 39.7	14.9	10 20.7	11.8	54.8	58	06 20	07 08	07 53	05 01	06 18	07 38	09 00
06	270 54.9	N17 50.5	283 13.6	14.9	N10 32.5	11.8	54.8	S 60	06 24	07 15	08 04	05 04	06 24	07 48	09 15
07	285 54.9	51.2	297 47.5	14.8	10 44.3	11.8	54.8								
08	300 54.9	51.8	312 21.3	14.7	10 56.1	11.7	54.8								
09	315 55.0	. . 52.5	326 55.0	14.7	11 07.8	11.7	54.8								
10	330 55.0	53.1	341 28.7	14.6	11 19.5	11.7	54.9								
11	345 55.0	53.7	356 02.3	14.6	11 31.2	11.6	54.9								
12	0 55.0	N17 54.4	10 35.9	14.5	N11 42.8	11.6	54.9								
13	15 55.0	55.0	25 09.4	14.4	11 54.4	11.5	54.9								
14	30 55.0	55.7	39 42.8	14.4	12 05.9	11.5	54.9								
15	45 55.0	. . 56.3	54 16.2	14.4	12 17.4	11.5	54.9								
16	60 55.1	56.9	68 49.6	14.2	12 28.9	11.4	54.9								
17	75 55.1	57.6	83 22.8	14.3	12 40.3	11.3	55.0								
18	90 55.1	N17 58.2	97 56.1	14.1	N12 51.6	11.3	55.0								
19	105 55.1	58.8	112 29.2	14.1	13 02.9	11.3	55.0								
20	120 55.1	17 59.5	127 02.3	14.0	13 14.2	11.2	55.0								
21	135 55.1	18 00.1	141 35.3	14.0	13 25.4	11.1	55.0								
22	150 55.1	00.8	156 08.3	13.9	13 36.5	11.2	55.0								
23	165 55.2	01.4	170 41.2	13.8	13 47.7	11.0	55.1								
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01	195 55.2	02.7	199 46.7	13.7	14 09.7	11.0	55.1								
02	210 55.2	03.3	214 19.4	13.7	14 20.7	10.9	55.1								
03	225 55.2	. . 03.9	228 52.1	13.5	14 31.6	10.8	55.1								
04	240 55.2	04.6	243 24.6	13.5	14 42.4	10.8	55.2								
05	255 55.2	05.2	257 57.1	13.4	14 53.2	10.7	55.2								
06	270 55.2	N18 05.8	272 29.5	13.4	N15 03.9	10.7	55.2								
07	285 55.3	06.5	287 01.9	13.3	15 14.6	10.6	55.2								
08	300 55.3	07.1	301 34.2	13.2	15 25.2	10.5	55.2								
09	315 55.3	. . 07.7	316 06.4	13.1	15 35.7	10.5	55.2								
10	330 55.3	08.3	330 38.5	13.1	15 46.2	10.5	55.3								
11	345 55.3	09.0	345 10.6	13.0	15 56.7	10.3	55.3								
12	0 55.3	N18 09.6	359 42.6	12.9	N16 07.0	10.3	55.3								
13	15 55.3	10.2	14 14.5	12.8	16 17.3	10.2	55.3								
14	30 55.3	10.9	28 46.3	12.8	16 27.5	10.2	55.3								
15	45 55.3	. . 11.5	43 18.1	12.7	16 37.7	10.1	55.3								
16	60 55.4	12.1	57 49.8	12.6	16 47.8	10.0	55.4								
17	75 55.4	12.7	72 21.4	12.6	16 57.8	9.9	55.4								
18	90 55.4	N18 13.4	86 53.0	12.4	N17 07.7	9.9	55.4								
19	105 55.4	14.0	101 24.4	12.4	17 17.6	9.8	55.4								
20	120 55.4	14.6	115 55.8	12.4	17 27.4	9.8	55.4								
21	135 55.4	. . 15.2	130 27.2	12.2	17 37.2	9.6	55.5								
22	150 55.4	15.9	144 58.4	12.2	17 46.8	9.6	55.5								
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Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 10	Moonset 11	Moonset 12	Moonset 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	18 32	20 39	▭	▭
N 70	22 35	////	////	18 19	20 12	22 27	▭
68	21 47	////	////	18 09	19 52	21 47	24 15
66	21 17	////	////	18 00	19 37	21 20	23 14
64	20 54	22 23	////	17 53	19 24	20 59	22 40
62	20 37	21 47	////	17 47	19 13	20 43	22 15
60	20 22	21 22	////	17 42	19 04	20 29	21 55
N 58	20 09	21 03	22 32	17 37	18 56	20 17	21 39
56	19 59	20 47	22 00	17 33	18 49	20 07	21 25
54	19 49	20 34	21 36	17 30	18 43	19 58	21 14
52	19 41	20 22	21 18	17 26	18 37	19 50	21 03
50	19 33	20 12	21 03	17 23	18 32	19 43	20 54
45	19 17	19 51	20 34	17 17	18 21	19 27	20 35
N 40	19 04	19 35	20 12	17 12	18 12	19 15	20 19
35	18 53	19 21	19 55	17 07	18 05	19 04	20 05
30	18 44	19 10	19 41	17 03	17 58	18 55	19 54
20	18 27	18 51	19 18	16 56	17 46	18 39	19 34
N 10	18 13	18 35	19 01	16 50	17 36	18 25	19 17
0	18 00	18 22	18 47	16 44	17 27	18 12	19 01
S 10	17 47	18 09	18 34	16 38	17 17	18 00	18 45
20	17 33	17 56	18 23	16 32	17 07	17 46	18 28
30	17 17	17 42	18 11	16 25	16 56	17 30	18 09
35	17 08	17 35	18 05	16 21	16 50	17 21	17 57
40	16 58	17 27	17 59	16 17	16 42	17 11	17 45
45	16 46	17 17	17 53	16 11	16 33	16 59	17 29
S 50	16 31	17 07	17 46	16 05	16 23	16 44	17 11
52	16 25	17 02	17 43	16 02	16 18	16 38	17 02
54	16 17	16 56	17 39	15 59	16 13	16 30	16 52
56	16 09	16 50	17 36	15 56	16 07	16 22	16 41
58	15 59	16 44	17 32	15 52	16 01	16 12	16 28
S 60	15 48	16 36	17 28	15 48	15 54	16 02	16 14

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
10	03 37	03 38	11 56	10 34	22 55	28	4
11	03 39	03 40	11 56	11 16	23 38	29	1
12	03 41	03 41	11 56	12 01	24 25	00	0

Explorations in Computing
Chapter 1 - Introduction

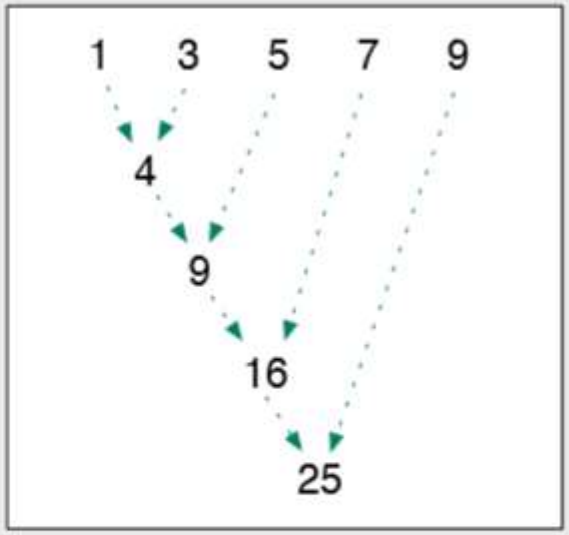
- The idea of computation using a series of simple and straightforward operations was already well established in 19th century.
- COMPUTER was a job title – referring to a person who was engaged in systematic calculation of values.
- Babbage realized that the simple operations carried out by human computers were mechanical in nature, and he dreamed of one day building a machine that would be able to carry out the steps in a computation automatically.
- Charles Babbage designed a machine called the "Difference Engine" to ease the calculations.
- Today complex computation is on fingertips by pressing a button on a calculator.

Method of differences: Concept behind difference engine

Squaring without Multiplying

You might think that to compute the value of n^2 you would need to know how to multiply $n \times n$. But there is an easy way to square a number using only additions.

The diagram at right shows how to compute 5^2. At the top of a piece of paper write the first 5 odd numbers. Add the first two numbers and write the sum below them. Then add the next odd number to the sum computed on the previous step. Keep adding numbers from the top row, and after adding the last number you'll have the value of 5^2.



This process is known as the "method of differences" and it is similar to the process Babbage and Herschel taught their workers. In 1823 Babbage started work on a mechanical computer called The Difference Engine that was based on this technique for evaluating polynomials.

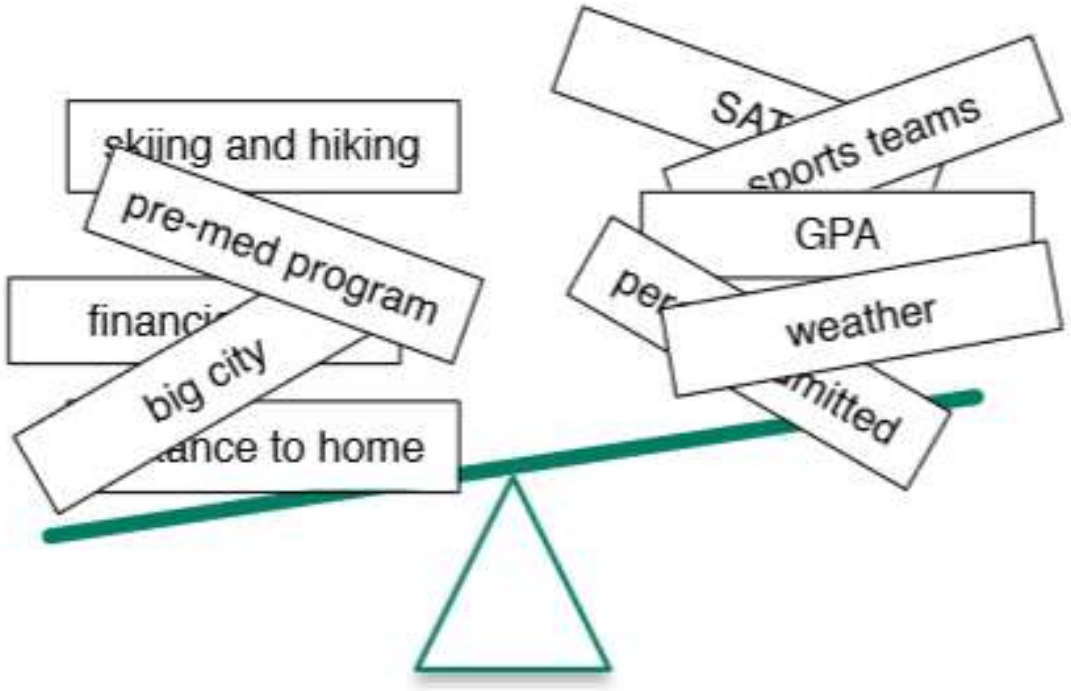
What is the definition of computation?

- Computation is a sequence of simple, well defined steps that lead to the solution of a problem.
- The problem must be defined exactly and unambiguously.
- Each computation step must be described in a very specific terms.
- Simple example of computation: Compare lengths of fish found in two different lakes.
  - How many samples?
  - What is average length?

Limits of Computation

What computer can do?	What computer cannot do?
Send email to a person if email address is known.	Find email of a person we met at a coffee shop.
Calculate difference investment options based on historical data.	Choose a perfect investment or predict success and future of companies.
Find information about colleges offering computer science course.	Make a perfect decision on the best school to attend.
Solve well defined problems.	Solve ambiguous problems.

Choosing a school



Unsolvable problems

- If a computer tries to analyze every possible sequence of moves in response to this opening in a game of chess, it will have to consider over 1043 different games.
- Computer solving one trillion combinations per second will compute the perfect game of chess if we are patient enough to wait 10^{21} years, so it is only unsolvable in a practical sense.

Algorithm

- An algorithm is characterized by
  - a precise statement of the starting conditions, which are the inputs to the algorithm;
  - a specification of the final state of the algorithm, which is used to decide when the algorithm will terminate;
  - a detailed description of the individual steps, each of which is a simple and straightforward operation that will help move the algorithm toward its final state.
- The earliest algorithm known as Euclid's algorithm dates from 300 BC and used to find the Lowest Common Denominator of two numbers.

Algorithm to compute the mean/average of a set of numbers

(a)

Input: *L*, a list of numbers

Initialize *S* (the sum) to 0

Let *N* be the number of items in *L*

Repeat until *L* is empty:

- Add the first item in *L* to *S*
- Remove the first item from *L* ★

Output: *S* divided by *N*

(b)

S	*L*
0	40, 39, 69, 57, 50
40	~~40~~, 39, 69, 57, 50
79	~~40~~, ~~39~~, 69, 57, 50
148	~~40~~, ~~39~~, ~~69~~, 57, 50
205	~~40~~, ~~39~~, ~~69~~, ~~57~~, 50
255	~~40~~, ~~39~~, ~~69~~, ~~57~~, ~~50~~

255 / 5 = 51

- The description of algorithm given in English or other human language is known as pseudocode – a simplified programming language.

Homework

- Go through the first three videos on "Python tutorial for beginners"
  - Getting started and installing
  - Numbers and maths Python
  - Variables and inputs
- https://www.youtube.com/watch?v=41qgdwd3zAg&index=1&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
- Write a python code to find average of a set of 10 numbers.