(17) $(p \wedge (p \wedge q)) \vee (q \wedge \sim q)$

$\Leftrightarrow$ $((p \wedge p) \wedge q) \vee (q \wedge \sim q)$ Associative

$\Leftrightarrow$ $(p \wedge q) \vee (q \wedge \sim q)$ Idempotent

$\Leftrightarrow$ $(p \wedge q) \vee 0$ Complement

$\Leftrightarrow$ $p \wedge q$ Identity

(18) $A\overline{B}\,(B + C + \overline{B + C}) + \overline{B}A$

$\Leftrightarrow$ $A\overline{B}\,(1) + \overline{B}A$ Complement

$\Leftrightarrow$ $A\overline{B} + \overline{B}A$ Identity

$\Leftrightarrow$ $\overline{B}A + \overline{B}A$ Commutative

$\Leftrightarrow$ $\overline{B}A$ Idempotent

(19) $(\overline{B+A} + \bar{B}A)(B+\bar{A})$

$\Leftrightarrow (\bar{B}\bar{A} + \bar{B}A)(B+\bar{A})$ De Morgan's

$\Leftrightarrow \bar{B}(\bar{A}+A)(B+\bar{A})$ Distributive

$\Leftrightarrow \bar{B}(1)(B+\bar{A})$ Complement

$\Leftrightarrow \bar{B}(B+\bar{A})$ Identity

$\Leftrightarrow \bar{B}\bar{A}$ Absorption

(20) $\sim(\sim p \wedge \sim q) \wedge (p \wedge \sim r)$

$\Leftrightarrow (\sim\sim p \vee \sim\sim q) \wedge (p \wedge \sim r)$ De Morgan's

$\Leftrightarrow (p \vee q) \wedge (p \wedge \sim r)$ Complement

$\Leftrightarrow ((p \vee q) \wedge p) \wedge \sim r$ Associative

$\Leftrightarrow (p \wedge (p \vee q)) \wedge \sim r$ Commutative

$\Leftrightarrow p \wedge \sim r$ Absorption

(21) a) MAYBE

b) No

c) YES

d) MAYBE

(22) a) Contrapositive of original:
Logically equivalent to original.

b) Converse of original.
Not logically equivalent to original.

c) Inverse of original.
Not logically equivalent to original.

(23) a) No

b) YES

c) No

d) YES

(24) a) $a_n = \sqrt{n}$ for $2 \leq n \leq 7$

Alternatively:

$a_n = \sqrt{n+1}$ for $1 \leq n \leq 6$

b) Each term is the previous term + 2

$$\begin{cases} a_1 = 6 \\ a_n = a_{n-1} + 2 \quad \text{for } n \geq 2 \end{cases}$$

Alternatively:

$$\begin{cases} a_0 = 6 \\ a_n = a_{n-1} + 2 \quad \text{for } n \geq 1 \end{cases}$$

(25) $\sum_{i=3}^{8} (2^i - 3)$

$= (2^3 - 3) + (2^4 - 3) + \dots + (2^8 - 3)$

$= 5 + 13 + 29 + 61 + 125 + 253$

$= 486$

(26) Arithmetic sequence with $a_1 = -38$ and $d = -3$

$a_n = a_m + (n-m)d$ for $n \geq m$

Sub $m = 1$: $a_n = a_1 + (n-1)d$ for $n \geq 1$

$a_n = -38 + (n-1)(-3)$

$a_n = -38 - 3n + 3$

$\boxed{a_n = -35 - 3n \text{ for } n \geq 1}$

(27) $a_n = a_m + (n-m)d$ for $n \geq m$

Find d:

Sub $n=21$ and $m=8$:

$$a_{21} = a_8 + 13d$$
$$-67 = -15 + 13d$$
$$-52 = 13d$$
$$d = -4$$

Find a_1:

$$a_n = a_m + (n-m)d \quad \text{for } n \geq m$$

Sub $n=8$ and $m=1$:

$$a_8 = a_1 + 7d$$
$$-15 = a_1 + 7(-4)$$
$$-15 = a_1 - 28$$
$$13 = a_1$$

(28) $\sum_{i=3}^{43} (5i+2)$

$= 17 + 22 + 27 + \dots + 217$

Arithmetic Series

a_m a_n

$k = \#$ of terms

$= n - m + 1$

$= 43 - 3 + 1$

$= 41$

$S_k = \frac{k}{2}(a_m + a_n)$

$= \frac{41}{2}(17 + 217)$

$= 4797$

(29) Geometric Sequence with $a_1 = 81$ $r = \frac{1}{3}$

$$\begin{cases} a_1 = 81 \\ a_n = \frac{1}{3} a_{n-1}, & n \geq 2 \end{cases}$$

(30) Geometric Sequence
with $a_1 = 4 \quad r = -2$

$$a_n = a_m r^{n-m} \quad \text{for } n \geq m$$

Sub $n = 20, m = 1$:

$$a_{20} = a_1 r^{19}$$
$$= 4(-2)^{19}$$
$$= -2097152$$

(31) Geometric series with
$a_1 = 1000 \quad r = \frac{1}{2}$

a) $$S_k = \frac{a_m(1 - r^k)}{1 - r}$$

Sub $k = 12, m = 1$:

$$S_{12} = \frac{a_1(1 - r^{12})}{1 - r}$$
$$= \frac{1000\left(1 - \left(\frac{1}{2}\right)^{12}\right)}{\left(\frac{1}{2}\right)}$$
$$\approx 1999.51$$

b) $-1 < r < 1$ ✓

$$S_\infty = \frac{a_m}{1-r}$$

$$= \frac{a_1}{1-r}$$

$$= \frac{1000}{\left(\frac{1}{2}\right)}$$

$$= 2000$$

(32) a) Program 2

b) Program 1

c) 100,000

(33) a) $O(n^2)$ b) $O(1)$ c) $O(n)$

d) $O(2^n)$ e) $O(n!)$ f) $O(n!)$

g) $O(n \log n)$ h) $O(\log n)$ i) $O(n)$

(34) $O(1)$, $O(\log n)$, $O(n)$, $O(n \log n)$,

$O(n^2)$, $O(2^n)$, $O(n!)$

(35) a) Each car is an experimental unit.

b) Make — QUALITATIVE

Distance or Odometer — DISCRETE

Diameter of Tire — CONTINUOUS

(36) a) Unimodal Skewed Left

b) The grades in the 0-10% range are outliers.

c) The 70-80% range is the mode.

d) $\frac{10}{100} = 10\%$

(37) The percentages do not add to 100%.