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## ADULT ROUTINE CHEST CT

### Indications (include but are not limited to)

- Evaluation of findings on chest radiographs or other CT exams as seen on other imaging modalities;
- Evaluation of lung and other primary thoracic malignancies, and detection and evaluation of metastatic disease;
- Evaluation for thoracic manifestations of known extrathoracic diseases;
- Evaluation of chest infections;
- Evaluation of inflammations involving the chest;
- Evaluation of abnormalities within the chest; i.e. fluid or abscess
- Evaluation of the chest wall;
- Evaluation of pleural disease;
- Evaluation of the mediastinum and lymph nodes.

### Diagnostic Tasks (include but are not limited to)

- Detect nodules or masses and characterize their size and shape and relationships to organs;
- Identify abnormal aeration or expansion of the lungs;
- Detect abnormal fluid collections in the chest;
- Identify abnormal air collections both in and around the lungs;
- Detect mediastinal and paravascular masses and nodules;
- Characterize chest wall masses;
- Detect calcifications in soft tissues or the mediastinum.

### Key Elements

- Contrast enhancement;
- One breath-hold (motion is problematic);
- Can reconstruct additional images for high-resolution chest CT.

### Contrast

- **Oral:** None.
- **Injected:** Certain indications require administration of intravenous contrast media.
- Intravenous contrast enhancement should be performed as directed by the supervising radiologist using appropriate injection protocols and in accordance with the [ACR-SPR Practice Guideline for the Use of Intravascular Contrast Media](#) and the [ACR Manual on Contrast Media](#).

### Patient Positioning

- Center the patient within the gantry; this is critical for proper functioning of AEC systems.
- Patient supine, arms above head;

### Scan Range

- From top of lungs through the bottom of lungs. Instruct patient to hold breath at inspiration during entire scan.

### Suspension of Respiration

- Patient should be instructed to hold his/her breath at end of inspiration.

### **Additional Image Reconstructions**

- Certain indications may require that images be reconstructed in coronal and/or sagittal planes.
- Very thin images (approximately  $\leq 1$  mm) may need to be reconstructed to serve as source images for the sagittal and/or coronal reformatted images.
- Creation, use, and archival of these additional images are at the discretion of the supervising radiologist and/or departmental policy. Very large datasets may result from these additional reconstructions.

### **Radiation Dose Management**

- AEC should be used whenever possible.
- Pay careful attention to the values selected to define the desired level of image quality (e.g., Noise Index, Quality Reference mAs, Standard Deviation).
- Each manufacturer will have recommendations unique to their systems and system features. Be sure to work with your CT equipment manufacturer and a qualified medical physicist to ensure safe and appropriate operation of AEC systems.
- If more than one CT localizer radiograph is acquired, AEC systems from different manufacturers can differ with respect to which one is used to determine mA and/or kV settings. Please refer to individual manufacturer protocol instructions.

## Approximate Volume CT Dose Index (CTDIvol) Values

- Approximate values for CTDIvol are listed for three different patient sizes:

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Average Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

The approximate CTDIvol values are for reference only and represent a dose to the CT Dose Index phantom under very specific conditions. The CTDIvol displayed on the scanner for a patient of a given size should be similar, but not necessarily an exact match, to those listed in the above table. The provided values are all based on the 32 cm diameter “body” CTDI phantom.

It is essential that users recognize that the CTDIvol values reported on the user console prior to acquiring CT localizer radiographs on a particular patient do not represent the CTDIvol that will be delivered during that patient’s scan. CT systems rely on the CT localizer radiograph to 1) estimate the patient’s size, 2) determine the tube current settings for each tube angle and table position that will yield the requested level of image quality, and 3) calculate the average CTDIvol for the patient over the prescribed scan range. Until the CT localizer radiograph is acquired, the reported CTDIvol is not patient-specific, but is based on a generic patient size.

The CTDIvol values provided here are approximate, and are intended only to provide reference ranges for the user to consider. They are for a routine CT of an adult’s chest for the general indications given at the beginning of this document. Other indications or diagnostic tasks may have different image quality and dose requirements, and hence reasonable ranges of CTDIvol may differ according to those requirements.

In this document, a small patient is considered to be approximately 50-70 kg (110-155 lbs), an average patient approximately 70-90 kg (155-200 lbs), and a large patient 90-120 kg (200-265 lbs). However, weight is not a perfect indication of patient size. A person’s height, gender and distribution of weight across the body also must be taken into account. The thickness of the body over the area to be scanned is the best indication of patient size. Body Mass Index (BMI) may also be considered:

- Underweight = BMI <18.5
- Normal weight = BMI of 18.5–24.9
- Overweight = BMI of 25–29.9
- Obesity = BMI of 30 or greater

It is recognized that the median (50<sup>th</sup> percentile) patient size for adults in the USA is larger than 70 kg. However, the 70 kg patient represents the “Reference Man”, as defined by the International Commission on Radiation Protection (ICRP), upon which AEC systems and tissue weighting factors (used for effective dose estimation) are based.

### CTDI measurements and calculations

- Some manufacturers utilize a z-axis “flying focal spot”, in which two unique projections are acquired at the same z-axis table position. When this technique is used, we identify it with \*\*. The CTDIvol on the console accurately accounts for use of this feature.

## INDEX OF ADULT ROUTINE CHEST PROTOCOLS (by manufacturer)

[GE](#)

[Hitachi](#)

[Neusoft](#)

[Neurologica](#)

[Philips](#)

[Siemens](#)

[Toshiba](#)

**ADULT ROUTINE CHEST CT (Selected GE scanners)**

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**SCOUT:** AP S60-I400; scan from top of shoulder through mid-liver, if automatic exposure control is used. PA scout if manual mA is used.

GE (Without ASIR)	LightSpeed Ultra	BrightSpeed 16 Select	BrightSpeed 16 / Lightspeed 16	LightSpeed Pro16	LightSpeed VCT / Discovery CT750
Scan Type	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.8	0.5	0.5	0.4
Beam Collimation (mm)	10	20	20	20	40
Pitch	1.35	1.35	1.35	1.35	1.375
Speed (mm/rot)	13.5	27.5	27.5	27.5	55.0
kV	120	120	120	120	120
SmartmA min-max mA (ave mA)	No SmartmA mA = 300	50 – 260 (160)	100 – 440 (260)	100 – 650 (270)	100 – 650 (500)
		NI*	11.57	11.57	11.57
SFOV	Large	Large	Large	Large	Large

**RECON 1**

Plane	Axial	Axial	Axial	Axial	Axial
Algorithm	STD	STD	STD	STD	STD
Recon Mode	Full	Full	Full	Full	Full
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5

**RECON 2**

Plane	Axial	Axial	Axial	Axial	Axial
Algorithm	Lung	Lung	Lung	Lung	Lung
Recon Mode	Full	Full	Full	Full	Full
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**

\*The Noise Index value and the primary (RECON 1) image reconstruction thickness both strongly impact CTDIvol and patient dose. See: Kanal KM et al. Impact of Operator-Selected Image Noise Index and Reconstruction Slice Thickness on Patient Radiation Dose in 64-MDCT. *AJR* 2007; 189: 219-225.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

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**ADULT ROUTINE CHEST CT (selected GE scanners)(continued)**

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**SCOUT:** AP S60-I400; scan from top of shoulder through mid-liver, if automatic exposure control is used. PA scout if manual mA is used.

GE (With ASIR)		VCT	Discovery CT750 HD
Scan Type		Helical	Helical
Rotation Time (s)		0.4	0.4
Beam Collimation (mm)		40	40
Pitch		1.375	1.375
Speed (mm/rot)		55.0	55.0
kV		120	120
SmartmA	min-max	100 – 650 (250)	100 – 650 (250)
	NI*	13.0 (DR 50%)	16.8
SFOV		Large	Large

**RECON 1**

Plane	Axial	Axial
Algorithm	STD	STD
Recon Mode	Full	Full
Thickness (mm)	5	5
Interval (mm)	5	5
ASIR	SS50	SS50

**RECON 2**

Plane	Axial	Axial
Algorithm	Lung	Lung
Recon Mode	Full	Full
Thickness (mm)	5	5
Interval (mm)	5	5
ASIR	SS50	SS50

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**

\*The Noise Index value and the primary (RECON 1) image reconstruction thickness both strongly impact CTDIvol and patient dose. See: Kanal KM et al. Impact of Operator-Selected Image Noise Index and Reconstruction Slice Thickness on Patient Radiation Dose in 64-MDCT. *AJR* 2007; 189: 219-225.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

**ADULT ROUTINE CHEST CT (selected HITACHI scanners)**[\(Back to INDEX\)](#)**SCANOGRAM:** Lat and PA (PA only for CXR4); scan from top of shoulder through mid-liver.

HITACHI	CXR4	ECLOS 16	Supria 16	SCENARIA 64
Scan Type	Volume	Volume	Volume	Volume
Rotation Time (s)	0.8	0.8	0.75	0.75
Detector Configuration	2.5 x 4	1.25 x 16	1.25 x 16	0.625 x 64
Pitch	1.25	1.0625	1.0625	1.0781
Speed (mm/rot)	12.5	21.25	21.25	43.48
kV	120	120	120	120
mA	225	IntelliEC: 100-400 mA	IntelliEC: 100-400 mA	IntelliEC: 100-600 mA
Adaptive mA/IntelliEC	Yes	SD 15	SD 13	SD 16
SFOV	500	500	500	500
Prep Delay (s)	20	30	30	30

**RECON 1**

Series Description	Mediastinum	Mediastinum	Mediastinum	Mediastinum
Type	Axial	Axial	Axial	Axial
Filter	5	31	31	31C
Thickness (mm)	5	5	5	5
Interval (mm)	5	5	5	5

**RECON 2**

Series Description	Lung	Lung	Lung	Lung
Type	Axial	Axial	Axial	Axial
Filter	9	22	22	22C
Thickness (mm)	5	5	5	5
Interval (mm)	5	5	5	5

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22



**ADULT ROUTINE CHEST CT (selected NEUSOFT scanners)**[\(Back to INDEX\)](#)

SCOUT/SURVIEW: PA, 350 mm (Adjust to cover: Apices through adrenals)

NEUSOFT	NeuViz64i/e	NeuViz 16
Scan Type	Helical	Helical
Rotation Time (s)	0.5	0.6
Collimation	64 x 0.625*	16 x 1.5 mm
kVp	100	120
Reference mAs	200	200
Pitch	1.2	1.07
FOV (mm)	350	350
Resolution	Standard	Standard
Dose Modulation	O-DOSE	ACS & DOM

**RECON 1**

Type	Axial	Axial
Filter	F20	SB
Thickness (mm)	5	5
Increment (mm)	5	5
ClearView	30%	N/A

**RECON 2**

Type	Axial	Axial
Filter	Lung20	LungB
Thickness (mm)	5	5
Increment (mm)	5	5
ClearView	30%	N/A

\*Quad Sampling- Indicates that a z-axis flying focal spot technique is used to obtain twice as many projections as detector rows. Simultaneous x-y deflection is also incorporated.

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

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**ADULT ROUTINE CHEST CT (selected NEUROLOGICA scanners)**

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Scout: PA, scan from top of shoulder through mid-liver

NEUROLOGICA	BodyTom	BodyTom
Scan Type	Helical	Axial
Rotation Time (s)	1	1
Beam Collimation (mm)	40	10
Pitch	0.8	N/A
kV	120	120
mA with AEC	mA=50 to 200	mA=50 to 200
mA without AEC	mA=200	mA=200
SFOV	full	full

**RECON 1**

Plane	Axial	Axial
Algorithm	Soft Tissue	Soft Tissue
Recon Mode	Full	Full
Thickness (mm)	5	5
Interval (mm)	5	5

**RECON 2**

Plane	Axial	Axial
Algorithm	Lung	Lung
Recon Mode	Full	Full
Thickness (mm)	5	5
Interval (mm)	5	5

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

**ADULT ROUTINE CHEST CT (selected PHILIPS scanners)**

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**SURVIEW:** PA; scan from top of shoulder through mid-liver.

PHILIPS	Brilliance 16 slice	Brilliance 64 slice	Ingenuity CT (w/ iPatient)	Brilliance iCT SP (w/ iPatient)	Brilliance iCT (w/ iPatient)
Scan Type	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.5	0.4	0.33	0.33
Collimation	16 x 1.5 mm	64 x 0.625 mm	64 x 0.625 mm	64 x 0.625 mm	128 x 0.625 mm
Coverage (mm)	24	40	40	40	80
kV	120	120	120	120	120
mAs	140	140	140 (DoseRight DRI = 21 143 mAs @ 29 cm ref)	125 (DoseRight DRI = 21 125 mAs @ 29 cm ref)	125 (DoseRight DRI = 21 125 mAs @ 29 cm ref)
Pitch	1	1	1.1	1.2	1
FOV (mm)	350-500	350-500	350-500	350-500	350-500

**RECON 1**

Type	Axial	Axial	Axial	Axial	Axial
Filter	B/C	B/C	B/C	B/C	B/C
Thickness (mm)	5	5	5	5	5
Increment (mm)	5	5	5	5	5

**RECON 2**

Type	Axial	Axial	Axial	Axial	Axial
Filter	YA/YB	YA/YB	YA/YB	YA/YB	YA/YB
Thickness (mm)	5	5	5	5	5
Increment (mm)	5	5	5	5	5

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

**ADULT ROUTINE CHEST CT (selected SIEMENS scanners)**[\(Back to INDEX\)](#)

TOPOGRAM: PA, 512 mm, 120/130 kV; scan from top of shoulder through mid-liver.

SIEMENS	Emotion 16	Scope Power	Perspective 64 Perspective 128	Sensation 64
Scan Mode	Spiral	Spiral	Spiral	Spiral
Rotation Time (s)	0.68	0.6	0.6	0.5
Detector Configuration (mm)	16x0.6	16 x0.6	<sup>b</sup> 32 x 0.6 <sup>b</sup> 64 x 0.6	<sup>a</sup> 64 x 0.6 (32 x 0.6 = 19.2)
Pitch	1.5	1.5	1.3	1.4
kV	130	130	130	120
Quality ref.mAs	70	70/50 <sup>d</sup>	70/50 <sup>d</sup>	100
CARE kV	-	-	-	-
CARE Dose4D	ON	ON	ON	ON

**RECON 1**

Type	Axial	Axial	Axial	Axial
Kernel	B41s	B41s/I41s (3) <sup>d</sup>	B41s/I31s <sup>d</sup>	B31f (3) <sup>d</sup>
Slice (mm)	5	5	5	5
Increment (mm)	5	5	5	5

**RECON 2**

Type	Axial	Axial	Axial	Axial
Kernel	B70s	B70s/I80s (3) <sup>d</sup>	B70s/I80s (3) <sup>d</sup>	B70f/I80f (3) <sup>d</sup>
Slice (mm)	5	5	5	5
Increment (mm)	5	5	5	5

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**<sup>a</sup> indicates that a z-axis "flying focal spot" technique is used to obtain twice as many projections per rotation as detector rows<sup>b</sup> IVR (Interleaved Volume Reconstruction) is available to improve spatial resolution<sup>c</sup> If scanner is equipped with automatic kV selection (CARE kV), this should be activated by selecting "On".

- For non-contrast-enhanced exams, a Reference kV of 120/130 and a "Dose saving optimized for" slider position of 2 is recommended.
- For contrast-enhanced exams, a Reference kV of 120/130 and a "Dose saving optimized for" slider position of 7 is recommended.
- For exams requiring both a non-contrast-enhanced and a contrast-enhanced scan, where the change in mean CT number of a region may be relevant to the diagnosis, it is important that the kV be the same for both scans. You can force CARE kV to use the same kV by linking the series. The optimization is then done by considering all linked acquisitions and their individual slider settings.

<sup>d</sup> with ADMIRE, SAFIRE or IRIS. For ADMIRE and SAFIRE, the number in parenthesis indicates the recommended for the strength

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

**ADULT ROUTINE CHEST CT (selected SIEMENS scanners)**[\(Back to INDEX\)](#)

TOPOGRAM: PA, 512 mm, 120/130 kV; scan from top of shoulder through mid-liver.

SIEMENS	Definition (Dual Source)	Definition Edge Definition AS+ Flash (Dual source 128-slice)	Force (Dual source 192-slice)
Scan Mode	Spiral	Spiral	Spiral
Rotation Time (s)	0.5	0.5	0.5
Detector Configuration (mm)	<sup>a</sup> 64 x 0.6 (32 x 0.6=19.2)	<sup>a</sup> 128 x 0.6 (64 x 0.6=38.4)	<sup>a</sup> 192 x 0.6 (96 x 0.6=57.6)
Pitch	1.2	1.2	1.2
kV	120	120	110
Quality ref.mAs	110/66 <sup>d</sup>	110/66 <sup>d</sup>	51 <sup>d</sup>
CARE Dose4D	ON	ON	ON
CARE kV	<sup>c</sup> ON	<sup>c</sup> ON	<sup>c</sup> ON

**RECON 1**

Type	Axial	Axial	Axial
Kernel	B31f/l31f (3) <sup>d</sup>	B31f/l31f (3) <sup>d</sup>	Br40 (3) <sup>d</sup>
Slice (mm)	5	5	5
Increment (mm)	5	5	5

**RECON 2**

Type	Axial	Axial	Axial
Kernel	B80f/l70f (3) <sup>d</sup>	B80f/l70f (3) <sup>d</sup>	BI57 (3) <sup>d</sup>
Slice (mm)	5	5	5
Increment (mm)	5	5	5

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**<sup>a</sup> indicates that a z-axis "flying focal spot" technique is used to obtain twice as many projections per rotation as detector rows<sup>b</sup> IVR (Interleaved Volume Reconstruction) is available to improve spatial resolution<sup>c</sup> If scanner is equipped with automatic kV selection (CARE kV), this should be activated by selecting "On".

- For non-contrast-enhanced exams, a Reference kV of 120/130 and a "Dose saving optimized for" slider position of 2 is recommended.
- For contrast-enhanced exams, a Reference kV of 120/130 and a "Dose saving optimized for" slider position of 7 is recommended.
- For exams requiring both a non-contrast-enhanced and a contrast-enhanced scan, where the change in mean CT number of a region may be relevant to the diagnosis, it is important that the kV be the same for both scans. You can force CARE kV to use the same kV by linking the series. The optimization is then done by considering all linked acquisitions and their individual slider settings.

<sup>d</sup> with ADMIRE, SAFIRE or IRIS. For ADMIRE and SAFIRE, the number in parenthesis indicates the recommended for the strength

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

**ADULT ROUTINE CHEST CT (selected TOSHIBA scanners)**[\(Back to INDEX\)](#)**SCANOGRAM:** Dual scanogram: PA and LAT; 500 mm above shoulders to below liver.

TOSHIBA	Aq 16 Aq RXL	Aq 32	Aq 64	Aq PRIME Aq ONE / Premium	Aq ONE Vision
Scan Type	Helical	Helical	Helical	Helical	Helical
Rotation Time (s)	0.5	0.5	0.5	0.5	0.275
Detector Configuration	16 x 1.0 mm	32 x 0.5	64 x 0.5	80 x 0.5	80 x 0.5
Pitch	Fast (1.438)	Fast (1.406)	Fast (1.484)	Fast (1.388)	Standard (0.813)
Speed (mm/rot)	23	22.5	47.5	55.5	32.5
kV	120	120	120	120	120
mA	80-500 mA	80-500 mA	80-500 mA	80-500 mA	80-700 mA
<sup>SURE</sup> Exposure	Std (SD = 12.5)	Std (SD = 12.5)	Std (SD = 12.5)	Std (SD = 12.5)	Std (SD = 12.5)
AIDR 3D / QDS+	QDS+ (Aq 16) AIDR 3D (Aq RXL)	QDS+	AIDR 3D	AIDR 3D	AIDR 3D
SFOV (mm)	400 mm (L)	400 mm (L)	400 mm (L)	400 mm (L)	400 mm (L)

**RECON 1**

Type	Axial	Axial	Axial	Axial	Axial
<sup>SURE</sup> IQ Setting	Body Std Axial	Body Std Axial	Body Std Axial	Body Std Axial	Body Std Axial
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5

**RECON 2**

Type	Axial	Axial	Axial	Axial	Axial
<sup>SURE</sup> IQ Setting	Lung Std Axial	Lung Std Axial	Lung Std Axial	Lung Std Axial	Lung Std Axial
Thickness (mm)	5	5	5	5	5
Interval (mm)	5	5	5	5	5

\*The <sup>SURE</sup>IQ setting determines the reconstruction FC as well as other post-processing and reconstruction options, such as AIDR. The <sup>SURE</sup>IQ settings listed in this document refer to the manufacturer's default settings.

**ADDITIONAL RECONSTRUCTIONS MAY BE NEEDED BASED ON THE CLINICAL INDICATION.**

	Approx. Weight (kg)	Approx. Weight (lbs)	Approx. CTDIvol (mGy)
Small Patient	50-70	110-155	4-10
Avg. Patient	70-90	155-200	8-16
Large Patient	90-120	200-265	14-22

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